

Annex C: Document # 156-90000-893

NAME OF TEST: Field strength of spurious radiation of the transmitter

RULE PART NUMBER: 2.1053, 90.543(c) (e)

UNIT UNDER TEST Prototype Gemini 3.5 700/800 MHz

SERIAL NUMBER (S): C10-prototype 16-level FSK Gemini GCU III modem MAC ID#- NA
6085-102 S/N 15120 pilot MDP transceiver – spurious products

TEST CONDITIONS: FCC certified Open Area Test Site of Dataradio COR located at 299 Johnson
Avenue in Waseca, Minnesota

Standard Test Conditions, 25 C.

NAME OF TEST: Field Strength of Spurious Radiation

RULE PART NUMBER: 2.1053, 90.543(c) (e)

MINIMUM STANDARD: For 30 Watts: $43 + 10\log_{10}(30) = 57.8 \text{ dBc}$
 For 10 Watts: $43 + 10\log_{10}(10) = 53 \text{ dBc}$

90.543(e): in the band 1559 - 1610 MHz
 -70 dBW/MHz EIRP for wideband signals, and
 -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth

TEST RESULTS: Meets minimum standard (see data on the following page)

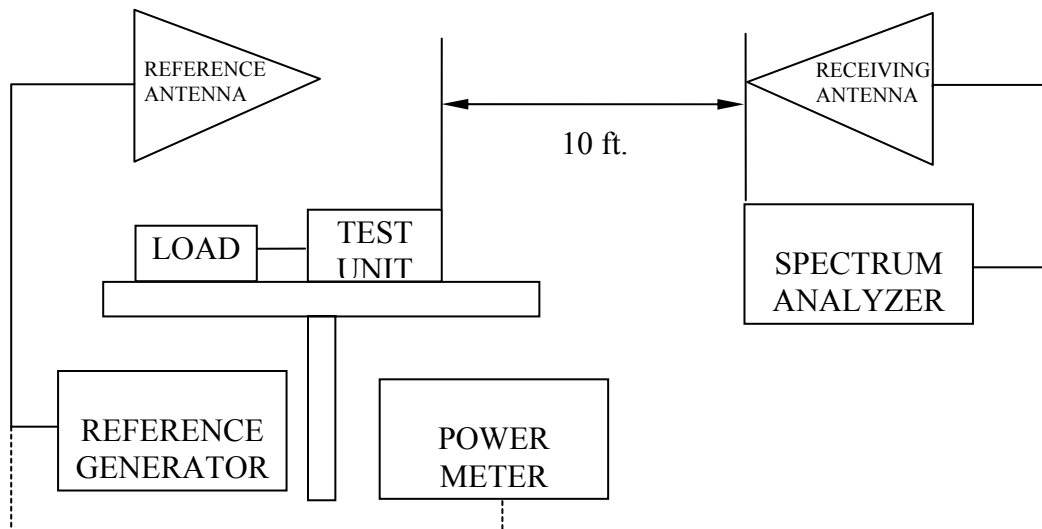
TEST CONDITIONS: Standard Test Conditions, 25 C

TEST PROCEDURE: TIA/EIA - 603, 2.2.12

TEST EQUIPMENT: Log Periodic Antenna, AIL TECH Model 9461
 Horn Antenna, Model EMCO 3115
 Reference Generator, Model Agilent E8257D
 Attenuator, BIRD Model / 50-A-MFN-20 / 20 dB / 50 Watt
 Attenuator, BIRD Model / 10-A-MFN-10 / 10 dB / 10 Watt
 Spectrum Analyzer, Model HP8563E
 Power Meter, Model HP437B
 Power Supply, Model HP-6024A

MEASUREMENT PROCEDURE: Radiated spurious attenuation was measured according to
 TIA/EIA Standard 603 Section 2.2.12

TEST SET-UP:



PERFORMED BY:

Daniel Hanson

Daniel Hanson

Date: 3/28/06

NAME OF TEST:

Spurious Radiation Attenuation (Continued)

Frequency:		800	MHz		Spec =		-57.8 dBc
Power:		30	Watts		Highest Spur =		-70.1 dBc
		44.8	dBm				
Spurious Frequency	Polarization	Spurious Level	Substitution Generator	Cable Loss	Antenna Gain	Spurious Attenuation	
(MHz)	(Horz/Vert)	(dBm)	(dBm)	(dB)	(dBd)	dBc	
1600	H	-91.2	-54.2	3.33	3.65	-98.6	
	V	-86.0	-49.8	3.33	3.65	-94.3	
2400	H	-83.7	-41.5	4.50	3.19	-87.6	
	V	-82.8	-39.5	4.50	3.19	-85.6	
3200	H	-69.2	-23.8	5.50	3.46	-70.6	
	V	-68.8	-23.3	5.50	3.46	-70.1	
4000	H	-89.0	-39.5	5.83	3.61	-86.5	
	V	-81.5	-30.8	5.83	3.61	-77.8	
4800	H	-86.5	-33.5	7.33	3.64	-82.0	
	V	-82.8	-29.2	7.33	3.64	-77.6	
5600	H	-81.3	-22.8	8.50	3.39	-72.7	
	V	-81.2	-22.7	8.50	3.39	-72.5	
6400	H	-97.2	-37.2	9.17	3.61	-87.5	
	V	-96.3	-36.3	9.17	3.61	-86.7	
7200	H	-93.8	-30.2	10.50	3.40	-82.0	
	V	-95.2	-31.5	10.50	3.40	-83.4	
8000	H	-95.5	-28.5	11.67	4.66	-80.3	
	V	-94.0	-26.8	11.67	4.66	-78.6	
Frequency:		800	MHz		Spec =		-53.0 dBc
Power:		10	Watts		Highest Spur =		-65.4 dBc
		40.0	dBm				
Spurious Frequency	Polarization	Spurious Level	Substitution Generator	Cable Loss	Antenna Gain	Spurious Attenuation	
(MHz)	(Horz/Vert)	(dBm)	(dBm)	(dB)	(dBd)	dBc	
1600	H	-86.6	-49.6	3.33	3.65	-89.3	
	V	-86.7	-50.5	3.33	3.65	-90.2	
2400	H	-78.2	-36.0	4.50	3.19	-77.3	
	V	-79.3	-36.0	4.50	3.19	-77.3	
3200	H	-68.7	-23.3	5.50	3.46	-65.4	
	V	-69.3	-23.8	5.50	3.46	-65.9	
4000	H	-87.5	-38.0	5.83	3.61	-80.2	
	V	-85.2	-34.5	5.83	3.61	-76.7	
4800	H	-95.0	-42.0	7.33	3.64	-85.7	
	V	-93.8	-40.2	7.33	3.64	-83.9	
5600	H	-94.3	-35.8	8.50	3.39	-80.9	
	V	-92.5	-34.0	8.50	3.39	-79.1	
6400	H	-96.8	-36.8	9.17	3.61	-82.4	
	V	-97.7	-37.7	9.17	3.61	-83.2	
7200	H	-101.7	-38.0	10.50	3.40	-85.1	
	V	-102.2	-38.5	10.50	3.40	-85.6	
8000	H	-102.7	-35.7	11.67	4.66	-82.7	
	V	-102.3	-35.2	11.67	4.66	-82.2	

NAME OF TEST: Spurious Radiation Attenuation-with Antenna (90.543(e))

Frequency: 800 MHz		Spec = -50.0 dBm				
Power: 30 Watts		Highest Spur = -53.2 dBm				
44.8 dBm						
Spurious Frequency	Polarization	Spurious Level	Substitution Generator	Cable Loss	Antenna Gain	Spurious Attenuation
(MHz)	(Horz/Vert)	(dBm)	(dBm)	(dB)	(dBd)	dBm
1600	H	-93.2	-53.5	3.33	3.65	-53.2
	V	-92.7	-54.3	3.33	3.65	-54.0
Frequency: 800 MHz		Spec = -50.0 dBm				
Power: 10 Watts		Highest Spur = -55.7 dBm				
40.0 dBm						
Spurious Frequency	Polarization	Spurious Level	Substitution Generator	Cable Loss	Antenna Gain	Spurious Attenuation
(MHz)	(Horz/Vert)	(dBm)	(dBm)	(dB)	(dBd)	dBm
1600	H	-95.7	-56.0	3.33	3.65	-55.7
	V	-96.5	-58.2	3.33	3.65	-57.8

CALCULATIONS FOR FIELD STRENGTH OF SPURIOUS RADIATION TESTS:

The transmitter carrier frequency was set to 800.000 MHz. The reference oscillator frequency of all of the transceivers is 17.50 MHz. The output of the transceiver was searched from 17.50 MHz to the tenth harmonic of the carrier frequencies. The tests were conducted with the transceiver/modem/GPS inside of the enclosure.

Because the antennas used for the measurements recorded above 1 GHz were not flat in gain and differed from a dipole, the generator output was corrected for gain at each spurious frequency. The cable loss in the measurements is the loss in the cable between the signal generator and the substitution antenna.

For part 90.543(e), the same procedure as above was used except a 0 dB mag-mount antenna (Maxrad Model: MUF4900 re-tuned to the 700MHz band) was connected to the transmitter port. A notch filter was used in front of the spectrum analyzer to notch the fundamental to extend the dynamic range of the spectrum analyzer.

EXAMPLE:

At 1600 MHz (800 MHz tuned), 30 Watts and horizontal polarization.

$$r = \text{Substitution Gen - Cable Loss} \quad -54.2 - 3.33 = -57.53$$

$$R = \text{Reference Generator (dBm)} \quad -57.5$$

$$A = \text{Antenna Gain (dBd)} \quad 3.65$$

$$R' (\text{Corrected Reference (dBm)}) = R + A \Rightarrow -57.5 + 3.65 = -53.85 \text{ dBm}$$

$$P_o = \text{Radiated Carrier Power (dBm)} \quad 30 \text{ Watts} = 44.8 \text{ dBm}$$

$$\text{Radiated Spurious Emission (dBc)} = P_o - R' \Rightarrow 44.8 - (-53.85) = \mathbf{98.65 \text{ dBc}}$$