

10. PEAK OUTPUT POWER OF THE BASE

Standard: FCC Part 15

Test procedure: paragraph 15.247

Test equipment:

TYPE	BRAND	EMITECH NUMBER
Spectrum analyzer FSP 40	Rohde & Schwarz	4088
Diode detector OD20004A	Omniyig	2469
Oscilloscope THS 720	Tektronix	0940
Antenna RGA60	Electrometrics	1938
Antenna RGA60	Electrometrics	1204
Open site	EMITECH	1274
Radio frequency generator SME06	Rohde & Schwarz	1669
High pass filter HPM11630	Micro-tronics	1673
Low-noise amplifier 1 to 18 GHz	ALC	2648
Variac R213	Dereix	1419
Power meter 8541B	Gigatronics	3479
Power sensor 80401A	Gigatronics	3182

Test set up:

The system is tested in an open area test site (OATS).

The test unit is placed on a rotating table, 0.8 m from a ground plane. Zero degree azimuth corresponds to the front of the equipment under test.

We use for this measure outdoor test site, by substitution method. The measuring distance between the equipment and the test antenna is 3 m. The antenna have been oriented in the two polarizations, we have recorded only highest level.

In first the spectrum analyzer is replaced by a diode detector which is connected to the vertical channel of an oscilloscope.

The equipment under test is then substituted by a signal generator with a calibrated double ridged guide antenna, and its level adjusted such that the deviation of the Y-trace of the oscilloscope reaches the level obtained with E.U.T.

The output power level of the signal generator is measured with a calibrated RF power meter.

Then a measurement of the electro-magnetic field is realized, with a resolution bandwidth and video bandwidth adjusted at 1 MHz.

Distance of antenna: 3 meters

Antenna height: 1 to 4 meters

Antenna polarization: vertical and horizontal

Equipment under test operating condition:

The equipment is blocked in continuous transmission mode, modulated by internal data signal.

Results:

Ambient temperature (°C): 19

Relative humidity (%): 36

Polarization of test antenna: horizontal (height: 239 cm)

Position of equipment: use position (azimuth: 249 degrees)

Sample N° 1

		Peak Output Power radiated at these frequencies (W): from 2402 MHz to 2480 MHz	Limits (W)
Normal test conditions	Nominal power source (V): 115	42.267 x 10 ⁻³	1*

* the frequency hopping systems use at least 75 hopping channel.

Sample n° 1 Channel 1

		Level dBμV	Cable loss dB	Antenna factor dB	Electro-magnetic field (dBμV/m):	P* (W)
Normal test conditions	Nominal power source (V): 115	74.25	4.41	27.77	106.43	7.99 x 10 ⁻³

Sample n° 1 Channel 40

		Level dBμV	Cable loss dB	Antenna factor dB	Electro-magnetic field (dBμV/m):	P* (W)
Normal test conditions	Nominal power source (V): 115	75.26	4.41	27.77	107.44	10.08 x 10 ⁻³

Sample n° 1 Channel 79

		Level dBμV	Cable loss dB	Antenna factor dB	Electro-magnetic field (dBμV/m):	P* (W)
Normal test conditions	Nominal power source (V): 115	75.49	4.41	27.77	107.67	10.63 x 10 ⁻³

 * P = (E x d)² / 30.Gp with d=3 and Gp = 1.65

Test conclusion:

RESPECTED STANDARD

11. PEAK OUTPUT POWER OF THE TERMINAL

Standard: FCC Part 15

Test procedure: paragraph 15.247

Test equipment:

TYPE	BRAND	EMITECH NUMBER
Spectrum analyzer FSP 40	Rohde & Schwarz	4088
Diode detector OD20004A	Omniyig	2469
Oscilloscope THS 720	Tektronix	0940
Antenna RGA60	Electrometrics	1938
Antenna RGA60	Electrometrics	1204
Open site	EMITECH	1274
Radio frequency generator SME06	Rohde & Schwarz	1669
High pass filter HPM11630	Micro-tronics	1673
Low-noise amplifier 1 to 18 GHz	ALC	2648
Power meter 8541B	Gigatronics	3479
Power sensor 80401A	Gigatronics	3182
Multimeter 77-2	Fluke	0812

Test set up:

The system is tested in an open area test site (OATS).

The test unit is placed on a rotating table, 0.8 m from a ground plane. Zero degree azimuth corresponds to the front of the equipment under test.

We use for this measure outdoor test site, by substitution method. The measuring distance between the equipment and the test antenna is 3 m. The antenna have been oriented in the two polarizations, we have recorded only highest level.

In first the spectrum analyzer is replaced by a diode detector which is connected to the vertical channel of an oscilloscope.

The equipment under test is then substituted by a signal generator with a calibrated double ridged guide antenna, and its level adjusted such that the deviation of the Y-trace of the oscilloscope reaches the level obtained with the E.U.T.

The output power level of the signal generator is measured with a calibrated RF power meter.

Then a measurement of the electro-magnetic field is realized, with a resolution bandwidth and video bandwidth adjusted at 1 MHz.

Distance of antenna: 3 meters

Antenna height: 1 to 4 meters

Antenna polarization: vertical and horizontal

Equipment under test operating condition:

The equipment is blocked in continuous transmission mode, modulated by internal data signal.

Results:

Ambient temperature (°C): 20.5

Relative humidity (%): 36

Polarization of test antenna: horizontal (height: 272 cm)

Position of equipment: flat position (azimuth: 0 degree)

Sample N° 1

		Peak Output Power radiated at these frequencies (W): from 2402 MHz to 2480 MHz	Limits (W)
Normal test conditions	Nominal power source (V): 7.4	31.623×10^{-3}	1*

* the frequency hopping systems use at least 75 hopping channel.

Sample n° 1 Channel 1

		Level dBμV	Cable loss dB	Antenna factor dB	Electro-magnetic field (dBμV/m):	P* (W)
Normal test conditions	Nominal power source (V): 7.4	69.63	4.41	27.77	101.81	2.76×10^{-3}

Sample n° 1 Channel 40

		Level dBμV	Cable loss dB	Antenna factor dB	Electro-magnetic field (dBμV/m):	P* (W)
Normal test conditions	Nominal power source (V): 7.4	71.78	4.41	27.77	103.96	4.53×10^{-3}

Sample n° 1 Channel 79

		Level dBμV	Cable loss dB	Antenna factor dB	Electro-magnetic field (dBμV/m):	P* (W)
Normal test conditions	Nominal power source (V): 7.4	70.61	4.41	27.77	102.79	3.46×10^{-3}

 * $P = (E \times d)^2 / 30 \cdot G_p$ with $d=3$ and $G_p = 1.65$
Test conclusion:

RESPECTED STANDARD

12. PEAK POWER DENSITY OF THE BASE

Standard: FCC Part 15

Test procedure: paragraph 15.247

Test equipment used:

TYPE	MANUFACTURER	EMITECH NUMBER
Spectrum analyzer FSP 40	Rohde & Schwarz	4088
Open site	Emitech	1274
Radiofrequency generator SME06	Rohde & Schwarz	1669
Antenna RGA-60	Electrometrics	1938
Antenna RGA-60	Electrometrics	1204
Variac R213	Dereix	1419
Power meter 8541B	Gigatronics	3479
Power sensor 80401A	Gigatronics	3182

Measured condition:

We used the same method of the peak output power, but the oscilloscope and the diode is replaced by a spectrum analyser used in combination with an RF power meter.

Resolution bandwidth: 3 kHz

Video bandwidth: 10 kHz

Test operating condition of the equipment:

The equipment is blocked in continuous transmission mode, modulated by internal data signal.

Results:

Ambient temperature (°C): 19

Relative humidity (%): 36

Power source (V): 115 Va.c. through a variac

Sample n° 1 Channel 1

	Peak power density at frequency: 2402 MHz
Normal test conditions	-1.78 dBm
Limits	+8 dBm

Sample n° 1 Channel 40

	Peak power density at frequency: 2441 MHz
Normal test conditions	-2.14 dBm
Limits	+8 dBm

Sample n° 1 Channel 79

	Peak power density at frequency: 2480 MHz
Normal test conditions	-0.7 dBm
Limits	+8 dBm

Test conclusion:

RESPECTED STANDARD

13. PEAK POWER DENSITY OF THE TERMINAL

Standard: FCC Part 15

Test procedure: paragraph 15.247

Test equipment used:

TYPE	MANUFACTURER	EMITECH NUMBER
Spectrum analyzer FSP 40	Rohde & Schwarz	4088
Open site	Emitech	1274
Radiofrequency generator SME06	Rohde & Schwarz	1669
Antenna RGA-60	Electrometrics	1938
Antenna RGA-60	Electrometrics	1204
Power meter 8541B	Gigatronics	3479
Power sensor 80401A	Gigatronics	3182
Multimeter 77-2	Fluke	0812

Measured condition:

We used the same method of the peak output power, but the oscilloscope and the diode is replaced by a spectrum analyser used in combination with an RF power meter.

Resolution bandwidth: 3 kHz

Video bandwidth: 10 kHz

Test operating condition of the equipment:

The equipment is blocked in continuous transmission mode, modulated by internal data signal.

Results:

Ambient temperature (°C): 20.5
Relative humidity (%): 36

We used for power source the internal battery of the equipment and we noted:

Voltage at the beginning of test (V): 8.24
Voltage at the end of test (V): 8.12
Percentage of voltage drop during the test (%): -1.5
Limit (%): ± 5

Sample n° 1 Channel 1

	Peak power density at frequency: 2402 MHz
Normal test conditions	-5.48 dBm
Limits	+8 dBm

Sample n° 1 Channel 40

	Peak power density at frequency: 2441 MHz
Normal test conditions	-6.64 dBm
Limits	+8 dBm

Sample n° 1 Channel 79

	Peak power density at frequency: 2480 MHz
Normal test conditions	-4.5 dBm
Limits	+8 dBm

Test conclusion:

RESPECTED STANDARD

14. RADIATED EMISSION OF THE BASE (TRANSMITTER)

Standard: FCC Part 15

Test procedure: paragraph 15.205
paragraph 15.209
paragraph 15.247

Test equipment:

TYPE	BRAND	EMITECH NUMBER
Test receiver ESH3	Rohde & Schwarz	1058
Test receiver ESVS 10	Rohde & Schwarz	1219
Spectrum analyzer FSP 40	Rohde & Schwarz	4088
Loop antenna	EMCO	1406
Biconical antenna HP 11966C	Hewlett Packard	728
Log periodic antenna HL 223	Rohde & Schwarz	1999
Open site	Emitech	1274
Antenna RGA-60	Electrometrics	1204
Low-noise amplifier 2 to 18 GHz	Microwave DB	1922
High pass filter HP12/3200-5AA	Filtek	
Antenna WR42	IMC	1939
Low-noise amplifier 18 to 26 GHz	ALC	3036
Variac R213	Dereix	1419

Test set up:

The system is tested in an open area test site (OATS).

The test unit is placed on a rotating table, 0.8 m from a ground plane. Zero degree azimuth corresponds to the front of the equipment under test.

Frequency range: from 9 kHz to harmonic 10 ($F_{\text{carrier}} \leq 10 \text{ GHz}$)

Detection mode: Quasi-peak ($F < 1 \text{ GHz}$)
Average ($F > 1 \text{ GHz}$)

Bandwidth: 120 kHz ($F < 1 \text{ GHz}$) or 100 kHz, following 15.205 or 15.247
1 MHz ($F > 1 \text{ GHz}$) or 100 kHz, following 15.205 or 15.247

Distance of antenna: between 30 m and 3 m according the frequencies and the limits.

Antenna height: 1 to 4 meters

Antenna polarization: vertical and horizontal

Equipment under test operating condition:

The equipment is blocked in continuous transmission mode, modulated by internal data signal.

Results:

Ambient temperature (°C): 18
Relative humidity (%): 65

Power source (V): 115 Va.c. through a variac

The polarity column refers to the antenna polarity at which the maximum emissions level is measured.

As the dwell time per channel of the hopping signal is less than 100 ms, the reading of any spurious that falls in a restricted band as defined in section 15-205 may be adjusted by a “duty cycle correction factor” derived from $20 \log (\text{dwell time} / 100 \text{ ms})$ according to the public notice DA 00-705.

We have noted:

dwell time = 436 μ s (see annex 2)

which gives correction factor of $20 \log (436 \times 10^{-3} / 100) = -47.2 \text{ dB}$

Frequencies (MHz)	Antenna height (cm)	Azimuth (dg)	RBW (kHz)	VBW (Hz)	Antenna Polarity	Field strength (dB μ V/m) without correction	Field strength (dB μ V/m) corrected (if applicable)	Limits (dB μ V/m)	Margin (dB)
4882.3	245	150	1000	10	V	62.83	15.63	54 *	38.37
7323.4	234	327	1000	10	H	60.68	13.48	54 *	40.52
9763.9	263	0	100	300 $\times$ 10 ³	V	51.97	N.A.	87.67	35.7

V: vertical

H: horizontal

* restricted band of operation as defined in section 15-205, limit corresponding to section 15-209.

N.A.: Not Applicable

Applicable limit: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the RF power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

The highest level recorded in a 100 kHz bandwidth is 107.67 dB μ V/m on channel 79. So the applicable limit is 87.67 dB μ V/m.

TEST CONCLUSION:

RESPECTED STANDARD

15.RADIATED EMISSION OF THE TERMINAL (TRANSMITTER)

Standard: FCC Part 15

Test procedure: paragraph 15.205
paragraph 15.209
paragraph 15.247

Test equipment:

TYPE	BRAND	EMITECH NUMBER
Test receiver ESH3	Rohde & Schwarz	1058
Test receiver ESVS 10	Rohde & Schwarz	1219
Spectrum analyzer FSP 40	Rohde & Schwarz	4088
Loop antenna	EMCO	1406
Biconical antenna HP 11966C	Hewlett Packard	728
Log periodic antenna HL 223	Rohde & Schwarz	1999
Open site	Emitech	1274
Antenna RGA-60	Electrometrics	1204
Low-noise amplifier 2 to 15 GHz	Microwave DB	1922
High pass filter HP12/3200-5AA	Filtek	
Antenna WR42	IMC	1939
Low-noise amplifier 18 to 26 GHz	ALC	3036
Multimeter 77-2	Fluke	0812

Test set up:

The system is tested in an open area test site (OATS).

The test unit is placed on a rotating table, 0.8 m from a ground plane. Zero degree azimuth corresponds to the front of the equipment under test.

Frequency range: from 9 kHz to harmonic 10 ($F_{\text{carrier}} \leq 10 \text{ GHz}$)

Detection mode: Quasi-peak ($F < 1 \text{ GHz}$)
Average ($F > 1 \text{ GHz}$)

Bandwidth: 120 kHz ($F < 1 \text{ GHz}$) or 100 kHz, following 15.205 or 15.247
1 MHz ($F > 1 \text{ GHz}$) or 100 kHz, following 15.205 or 15.247

Distance of antenna: between 30 m and 3 m according the frequencies and the limits.

Antenna height: 1 to 4 meters

Antenna polarization: vertical and horizontal

Equipment under test operating condition:

The equipment is blocked in continuous transmission mode, modulated by internal data signal.

Results:

Ambient temperature (°C): 18.5
Relative humidity (%): 55

We used for power source the internal battery of the equipment and we noted:

Voltage at the beginning of test (V): 8.27
Voltage at the end of test (V): 8.16
Percentage of voltage drop during the test (%): -1.3
Limit (%): ± 5

The polarity column refers to the antenna polarity at which the maximum emissions level is measured.

As the dwell time per channel of the hopping signal is less than 100 ms, the reading of any spurious that falls in a restricted band as defined in section 15-205 may be adjusted by a “duty cycle correction factor” derived from $20 \log (\text{dwell time} / 100 \text{ ms})$ according to the public notice DA 00-705.

We have noted:

dwell time = 436 μs (see annex 2)

which gives correction factor of $20 \log (436 \times 10^{-3} / 100) = -47.2 \text{ dB}$

Frequencies (MHz)	Antenna height (cm)	Azimuth (dg)	RBW (kHz)	VBW (Hz)	Antenna Polarity	Field strength (dB $\mu\text{V}/\text{m}$) without correction	Field strength (dB $\mu\text{V}/\text{m}$) corrected (if applicable)	Limits (dB $\mu\text{V}/\text{m}$)	Margin (dB)
353.9	330	110	120	-	H	42.4	N.A.	83.96	41.56
412.9	228	0	120	-	V	37.8	N.A.	83.96	46.16
471.9	203	100	120	-	H	44.6	N.A.	83.96	39.36
589.8	138	260	120	-	H	45.6	N.A.	83.96	38.36
648.8	124	250	120	-	H	43.1	N.A.	83.96	40.86
766.8	130	300	120	-	H	37.5	N.A.	83.96	46.46
1626.4	116	0	1000	10	V	38.55	-8.65	54 *	62.65
3257.7	148	0	100	300×10^3	V	25.93	N.A.	83.96	58.03
4882.3	150	52	1000	10	H	61.85	14.65	54 *	39.35
7323.5	246	349	1000	10	H	56.98	9.78	54 *	44.22
9763.9	216	224	100	300×10^3	V	52.81	N.A.	83.96	31.15
12205	256	0	1000	10	V	52.72	5.52	54 *	48.48

V: vertical

H: horizontal

* restricted band of operation as defined in section 15-205, limit corresponding to section 15-209.

N.A.: Not Applicable

Applicable limit: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the RF power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

The highest level recorded in a 100 kHz bandwidth is 103.96 dB $\mu\text{V}/\text{m}$ on channel 40. So the applicable limit is 83.96 dB $\mu\text{V}/\text{m}$.

TEST CONCLUSION: RESPECTED STANDARD

□□□ End of report, 4 annexes to be forwarded □□□