

VIII. Section 15.247 (C): Spurious Emissions (Radiated)

8.1 Test Condition & Setup

We'd performed the test by the *radiated emission skill*: The EUT was placed in an anechoic chamber, and set the EUT transmitting continuously and scanned at 3-meter distance to determine its emission characteristics. The physical arrangement of the EUT was varied (within the scope of arrangements likely to be encountered in actual use) to determine the effect on the unit's emanations in amplitude, directivity, and frequency. The exact system configuration, which produced the highest emissions was noted so it could be reproduced later during the final tests. For the measurement above 1GHz, according to the guidance we'd set the spectrum analyzer's 6dB bandwidth RBW to 1MHz.

This was done to ensure that the final measurements would demonstrate the worst-case interference potential of the EUT.

Final radiation measurements were made on a three-meter, anechoic chamber. The EUT system was placed on a nonconductive turntable, which is 0.8 meters height, top surface 1.0 x 1.5 meter.

The spectrum was examined from 30 MHz to 1000 MHz using an Hewlett Packard 85460A EMI Receiver, Schaffner whole range Bi-Log antenna (Model No.: CBL6141A) is used to measure frequency from 30 MHz to 1GHz. The final test is used the spectrum HP 85460A and spectrum was examined from 1GHz to 18GHz using an Hewlett Packard 8564E Spectrum Analyzer, EMCO Horn Antenna (Model 3115) for 1G ~ 18GHz.

At each frequency, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters to find the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarization.

Appropriate preamplifiers were used for improving sensitivity and precautions were taken to avoid overloading or desensitizing the spectrum analyzer. There are two spectrum analyzers use on this testing, HP 85460A for frequency 30MHz to 1000MHz, and 8564E for frequency 1GHz to 18GHz. No post-detector video filters were used in the test. The spectrum analyzer's 6dB bandwidth was set to 120KHz (spectrum was examined from 30 MHz to 1000 MHz), the spectrum analyzer's 6 dB bandwidth was set to 1 MHz (spectrum was examined from 1GHz to 18GHz) and the analyzer was operated in the maximum hold mode. There is a test condition apply in this test item, the test procedure description as the following:

Making access to the mode of continuous transmission by the software in the computer via the USB port. Three channels were tested, one in the top (CH01), one in the middle (CH06) and the other in bottom (CH11).

With the transmitter operating from a AC source and using the internal of EUT, radiates spurious emissions falling within the restricted bands of 15.209 were measured at operating frequencies corresponding to upper, middle and bottom channels in the 2400 ~ 2483.5 MHz band.

The actual field intensity in decibels referenced to 1 microvolt per meter (dB μ V/m) is determined by algebraically adding the measured reading in dB μ V, the antenna factor (dB), and cable loss (dB) at the appropriate frequency. Since the EUT was set to transmit continuously, no *duty cycle* is present.

For frequency between 30MHz to 1000MHz

$$F_{Ia} \text{ (dB}\mu\text{V/m)} = F_{Ir} \text{ (dB}\mu\text{V)} + \text{Correction Factors}$$

F_{Ia} : Actual Field Intensity

F_{Ir} : Reading of the Field Intensity

$$\text{Correction Factors} = \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

For frequency between 1 GHz to 18 GHz

$$F_{Ia} \text{ (dB}\mu\text{V/m)} = F_{Ir} \text{ (dB}\mu\text{V)} + \text{Correction Factor}$$

F_{Ia} : Actual Field Intensity

F_{Ir} : Reading of the Field Intensity

$$\text{Correction Factors} = \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The setting up procedure is recorded on Appendix A.

8.2 List of Test Instruments

Instrument Name	Model No.	Brand	Serial No.	Last time	Next time
Spectrum analyzer	8591EM	H P	3710A01203	05/29/02	05/29/03
Pre-selector (>30MHz)	AMP-01	TRC	REP-001	10/02/02	10/02/03
Spectrum analyzer	8568B	H P	3004A18617	06/19/02	06/19/03
Quasi-peak Adapter	85650A	H P	2521A00984	06/20/02	06/20/03
RF Pre-selector	85685A	H P	2947A01011	06/20/02	06/20/03
RF Pre-selector	AMP-01	TRC	REP-002	10/02/02	10/02/03
Bi-log Antenna	VULB9160	M. E.	3064	07/09/02	07/09/03
Antenna (30M-2GHz)	3142	EMCO	9610-1094	10/02/02	10/02/03
Open test side (Antenna, Amplify, cable calibrated together)				05/20/02	05/20/03
Spectrum Analyzer	8564E	HP	US36433002	08/01/02	08/01/03
Microwave Preamplifier	83051A	HP	3232A00347	08/01/02	08/01/03
Horn Antenna	3115	EMCO	9704 – 5178	08/01/02	08/01/03

The level of confidence of 95% , the uncertainty of measurement of radiated emission is $\pm 3.44\text{dB}$.

8.3 Test Result of Spurious Radiated Emissions

EUT's transmit only

The highest peak values of radiated emissions from the EUT at various antenna heights, antenna polarizations, EUT orientation, etc. are recorded on the following.

Test Conditions:

Testing room : Temperature : 28 ° C Humidity : 64 % RH

Table 1 Radiated Emissions for 30MHz 1GHz [Horizontal]

Radiated Emission				Correction Factors (dB)	Corrected Amplitude (dBm V/m)	FCC Class B (3 m)	
Frequency (MHz)	Amplitude (dBm V)	Ant. H. (m)	Table (°)			Limit (dBm V/m)	Margin (dB)
144.01	9.17	2.50	214	17.94	27.11	43.50	-16.39
240.02	7.81	1.00	28	18.53	26.34	46.00	-19.66
279.07	11.56	2.50	158	20.66	32.22	46.00	-13.78
333.12	12.42	1.00	146	22.21	34.63	46.00	-11.37
433.16	9.79	1.00	219	25.42	35.21	46.00	-10.79
748.00	1.88	1.00	324	33.70	35.58	46.00	-10.42

Note:

1. Margin = Amplitude – limit, *if margin is minus means under limit.*
2. Corrected Amplitude = Reading Amplitude + Correction Factors
3. Correction factor = Antenna factor + (Cable Loss – Amplitude gain)

Table 2 Radiated Emissions For 30MHz 1GHz [Vertical]

Radiated Emission				Correction Factors (dB)	Corrected Amplitude (dBm V/m)	FCC Class B (3 m)	
Frequency (MHz)	Amplitude (dBm V)	Ant. H. (m)	Table (°)			Limit (dBm V/m)	Margin (dB)
144.02	8.31	1.00	145	17.94	26.25	43.50	-17.25
192.02	8.56	2.50	235	16.91	25.47	43.50	-18.03
398.60	8.02	1.00	347	25.25	33.27	46.00	-12.73
432.05	4.46	1.00	164	25.42	29.88	46.00	-16.12
498.02	4.64	1.00	321	27.98	32.62	46.00	-13.38
748.00	1.72	1.00	89	33.70	35.42	46.00	-10.58

Table 3 Open Field Radiated Emissions For 1GHz 18GHz [Horizontal] [CH 1]

Radiated Emission				Corrected Amplitude		FCC Class B (3m)		
Frequency (MHz)	Ant. H. (m)	Table (°)	Correction Factors (dB)	(dB μ V/m)		Limit (dB μ V/m)		Margin (dB)
				Peak	Average	Peak	Ave.	
4825.14	1.00	135	3.76	41.22	---	74.00	54.00	-12.78

Table 4 Open Field Radiated Emissions For 1GHz 18GHz [Vertical] [CH 1]

Radiated Emission				Corrected Amplitude		FCC Class B (3m)		
Frequency (MHz)	Ant. H. (m)	Table (°)	Correction Factors (dB)	(dB μ V/m)		Limit (dB μ V/m)		Margin (dB)
				Peak	Average	Peak	Ave.	
2038.01	1.00	221	3.30	52.84	50.62	74.00	54.00	-3.38
4825.14	1.00	35	3.76	47.69	---	74.00	54.00	-6.31

Note:

1. Margin = Corrected - Limit.
2. The EUT utilizes a *permanently attached antenna*. In addition the spurious RF conducted emissions levels do comply with the *20dBc limit* both at its bandedges and other spurious emissions.
3. As stated in Section 15.35(b), for any frequencies above 1000MHz, radiated limits shown are based upon the use of measurement instrumentation employing an average detector function. As the results of our test, the peak amplitudes are already below the FCC limit. Thus the average amplitudes of the rest are omitted.

Table 5 Open Field Radiated Emissions For 1GHz 18GHz [Horizontal] [CH 6]

Radiated Emission				Corrected Amplitude		FCC Class B (3m)		
Frequency (MHz)	Ant. H. (m)	Table (°)	Correction Factors (dB)	(dBμV/m)		Limit (dBμV/m)		Margin (dB)
				Peak	Average	Peak	Ave.	
4873.47	1.00	134	3.95	45.28	---	74.00	54.00	-8.78

Table 6 Open Field Radiated Emissions For 1GHz 18GHz [Vertical] [CH 6]

Radiated Emission				Corrected Amplitude		FCC Class B (3m)		
Frequency (MHz)	Ant. H. (m)	Table (°)	Correction Factors (dB)	(dBμV/m)		Limit (dBμV/m)		Margin (dB)
				Peak	Average	Peak	Ave.	
2063.02	1.00	66	3.24	53.65	52.26	74.00	54.00	-1.74
4873.47	1.00	247	3.95	48.66	---	74.00	54.00	-5.34

Note:

1. Margin = Corrected - Limit.
2. The EUT utilizes a *permanently attached antenna*. In addition the spurious RF conducted emissions levels do comply with the *20dBc limit* both at its bandedges and other spurious emissions.
3. As stated in Section 15.35(b), for any frequencies above 1000MHz, radiated limits shown are based upon the use of measurement instrumentation employing an average detector function. As the results of our test, the peak amplitudes are already below the FCC limit. Thus the average amplitudes of the rest are omitted.

Table 7 Open Field Radiated Emissions For 1GHz 18GHz [Horizontal] [CH 11]

Radiated Emission				Corrected Amplitude		FCC Class B (3m)		
Frequency (MHz)	Ant. H. (m)	Table (°)	Correction Factors (dB)	(dBμV/m)		Limit (dBμV/m)		Margin (dB)
				Peak	Average	Peak	Ave.	
4925.84	1.00	266	4.13	43.50	---	74.00	54.00	-10.50

Table 8 Open Field Radiated Emissions For 1GHz 18GHz [Vertical] [CH 11]

Radiated Emission				Corrected Amplitude		FCC Class B (3m)		
Frequency (MHz)	Ant. H. (m)	Table (°)	Correction Factors (dB)	(dBμV/m)		Limit (dBμV/m)		Margin (dB)
				Peak	Average	Peak	Ave.	
2088.02	1.00	66	3.17	53.47	52.64	74.00	54.00	-1.36
4925.84	1.00	254	4.13	46.25	---	74.00	54.00	-7.75

Note:

1. Margin = Corrected - Limit.
2. The EUT utilizes a *permanently attached antenna*. In addition the spurious RF conducted emissions levels do comply with the *20dBc limit* both at its bandedges and other spurious emissions.
3. As stated in Section 15.35(b), for any frequencies above 1000MHz, radiated limits shown are based upon the use of measurement instrumentation employing an average detector function. As the results of our test, the peak amplitudes are already below the FCC limit. Thus the average amplitudes of the rest are omitted.