

13. RADIATED EMISSION LIMIT

Standard: FCC PART 15 : 2013

Section: 15.109

Instrumentation test list:

CATEGORY	BRAND	TYPE	N° EMITECH
Antenna	Schwarzbeck	VHA 9103	0317
Antenna	Schwarzbeck	UHALP 9108	3106
Antenna	Emco	3115	3374
Antenna mast	Maturo	AM 4.0-O	7625
Cable	Câbles & Connectiques	N-13m	2452
Cable	-	N-2m	2805
Cable	Câbles & Connectiques	N-SMA	2864
Cable	Micro-Coax	N-13m	8063
Cable	C&C	N-15m	10229
Filter	Trilithic	6HC1300-2.5-KK	1097
Filter	Trilithic	5EHLX500-3-KK	1529
Filter	Micro-tronics	HPM 14758	4691
Open area test site	Emitech	Aunainville	0187
Preamplifier	Mini-Circuits	ZFL-1000LN	0048
Preamplifier	MITEQ	AFS42-00102650-42-10P-42	3229
Spectrum analyzer	Rohde & Schwarz	FSP40 (V 4.00SP1-V3.0-10-2)	5175
Turntable	Maturo	MCU	7626

Equipment under test arrangement:

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 30 MHz to harmonic 5 (highest frequency used = 5805 MHz).

Bandwidth: 120 kHz ($F < 1$ GHz)
1 MHz ($F > 1$ GHz)

Detection mode: Quasi-peak ($F < 1$ GHz)
Average ($F > 1$ GHz)

Distance of antenna: 3 meters.

Antenna height: 1 to 4 meters

Antenna polarization: vertical and horizontal, only the highest level is recorded.

Operating mode during the test:

The E.U.T. is blocked in continuous transmission mode.

Results:

No frequencies are observed between 30 MHz to 25 GHz for both polarizations.

Test conclusion: Standard respected

14. DYNAMIC FREQUENCY SELECTION

Standard: FCC PART 15 : 2013

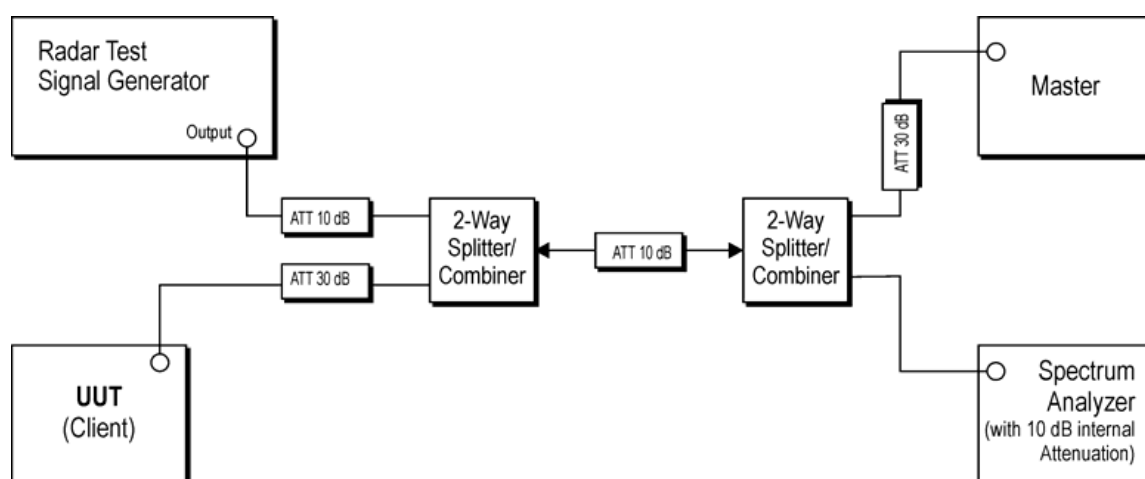
Section: 15.407 (h) (2)

Test equipment used:

CATEGORY	BRAND	TYPE	N° EMITECH
Receiver	Rohde & Schwarz	FSU8	9129
Synthesizer	Rohde & Schwarz	SMBV10QA	10351

Measured conditions:

The test is carried out in conducted mode and signal test radar type 1 of table 5 is generated.
The tests are carried out with a modulation type OFDM = 54 Mbps bandwidth 20 MHz (Mode a)



Signal generator = SMBV 100A R&S
Spectrum analyzer = SFU 8 R&S
Master = Access point "SagemCom"
Software used is "The DFS analysis tool" of R&S.

A connection between the control PC and the analyzer is carried out by GPIB.

Test operating condition of the equipment:

The equipment under test is associate a master.

Results:

Ambient temperature (°C): 23

Relative humidity (%): 50

Power source (V): 3.6

Tests :

Applicability of DFS requirements prior to use of a channel

Requirement	DFS operational mode		
	Master	Slave without radar detection	Slave with radar detection
Non-Occupancy Period	✓	Not required	✓
DFS Detection Threshold	✓	Not required	✓
Channel Availability Check Time	✓	Not required	Not required
Uniform Spreading	✓	Not required	Not required
U-NII Detection Bandwidth	✓	Not required	✓

Applicability of DFS requirements during normal operation

Requirement	DFS operational mode		
	Master	Slave without radar detection	Slave with radar detection
DFS Detection Threshold	✓	Not required	✓
Channel Closing Transmission Time	✓	✓	✓
Channel Move Time	✓	✓	✓
U-NII Detection Bandwidth	✓	Not required	✓

The equipment under test is a slave without radar detection.

Channel move time, Channel closing transmission time, and Non-occupancy period

Test method: FCC 06-96

Parameters of DFS test signal:

Radar Type	Pulse width (μsec)	PRI (μsec)	Number of Pulses
1	1	1428	18

Threshold level: The maximum transmit power at 5500 MHz is 14.359 mW → level is -62 dBm.

Channel move time

	Channel move time	Limit	Curve
Channel 100 Frequency : 5500 MHz	1.13 s	10 s	1

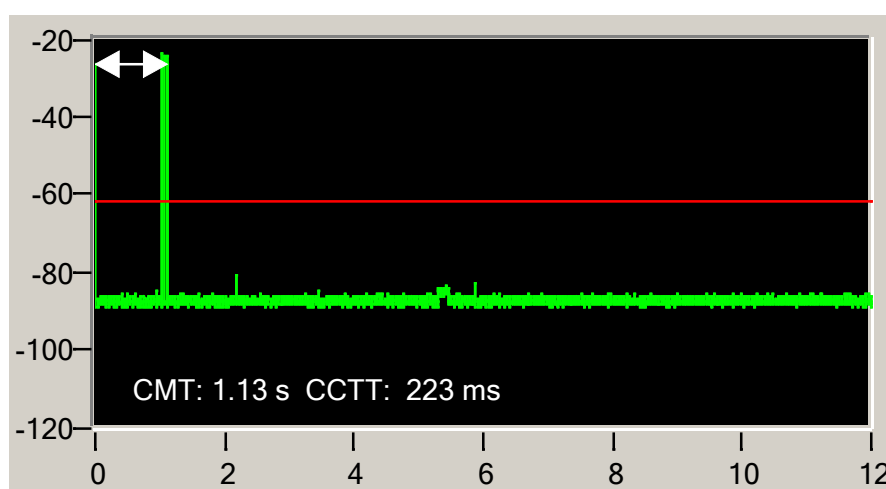
Channel closing transmission time

	Channel closing transmission time	Limit	Curve
Channel 100 Frequency : 5500 MHz	2.3 ms	< 60 ms	1

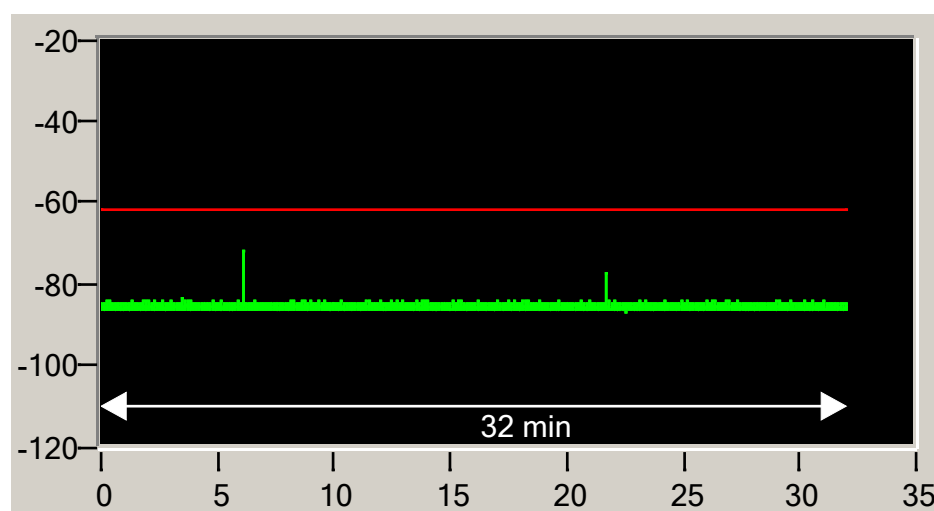
Non-occupancy period

	Non-occupancy period	Limit	Curve
Channel 100 Frequency : 5500 MHz	> 30 mn Nothing to report	> 30 mn	2

Curve 1:



Curve 2:



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

ANNEX 1

Antenna factors, insertion losses and amplifier values

BILL OF MATERIAL

The test antenna used for the radiated emission between 9 kHz and 30 MHz is the active loop antenna n°9579. Antenna factors are given in table 1.

The test antenna used for the radiated emission between 30 MHz and 200 MHz is the biconical antenna n°317. Antenna factors are given in table 2.

The test antenna used for the radiated emission between 200 MHz and 1 GHz is the log-periodic antenna n°3106. Antenna factors are given in table 3.

The measuring receiver n°1216 used in the frequency range 30 MHz to 1 GHz has an integrated preamplifier.

The spectrum analyzer n°5175 is used in the frequency range 1 GHz to 25 GHz.

The test cable used between 9 kHz and 30 MHz to connect the antennas to the receiver for measurements at a distance of 30 meters has losses given in table 4.

The test cable used between 30 MHz and 1 GHz to connect the antennas to the receiver for measurements at a distance of 3 meters has losses given in table 5.

The test antenna used for the radiated emission between 1 GHz and 18 GHz is the horn antenna n°3374. Factors are given in table 6.

The test antenna used for the radiated emission between 18 GHz and 25 GHz is the horn antenna n°1045. Factors are given in table 7.

The amplifier n°3229 used to connect the spectrum analyzer to the test cable has gain values given in the table 8.

The test cable used between 1 GHz and 26 GHz to connect the horn antenna to the amplifier for measurements at a distance of 3 meters has losses given in table 9.

Frequency (MHz)	Antenna factor (dB/m)	Frequency (MHz)	Antenna factor (dB/m)
0.009	- 21.8	0.8	- 35.2
0.01	- 22.7	1	- 35.2
0.015	- 25.7	1.5	- 35.3
0.02	- 28.4	2	- 35.4
0.03	- 31.2	3	- 35.4
0.05	- 33.6	5	- 35.4
0.08	- 34.7	8	- 35.4
0.1	- 35.0	10	- 35.4
0.15	- 35.4	15	- 35.4
0.2	- 35.5	20	- 35.7
0.3	- 35.5	25	- 36.1
0.5	- 35.4	30	- 36.9

TABLE 1 : ACTIVE LOOP ANTENNA

Frequency (MHz)	Antenna factor (dB/m)	Frequency (MHz)	Antenna factor (dB/m)
30	18.9	90	8.5
35	17.1	100	10.1
40	15.1	120	13.0
45	13.3	140	14.5
50	11.5	160	15.5
60	8.0	180	15.7
70	6.4	200	16.1
80	6.9	-	-

TABLE 2 : BICONICAL ANTENNA

Frequency (MHz)	Antenna factor (dB/m)	Frequency (MHz)	Antenna factor (dB/m)
200	24.0	700	20.6
300	14.5	800	21.1
400	16.8	900	22.2
500	17.9	1000	23.2
600	19.5	-	-

TABLE 3 : LOG-PERIODIC ANTENNA

Frequency (MHz)	Loss (dB)	Frequency (MHz)	Loss (dB)
0.009	0.0	6.000	0.5
0.020	0.0	7.000	0.5
0.050	0.0	8.000	0.5
0.100	0.0	9.000	0.6
0.500	0.1	10.00	0.6
1.000	0.2	15.00	0.7
2.000	0.2	20.00	0.8
3.000	0.3	25.00	1.0
4.000	0.4	30.00	1.1
5.000	0.4	-	-

TABLE 4 : TEST CABLE FOR 30M MEASUREMENT INTO 9 kHz
AND 30 MHz

Frequency (MHz)	Loss (dB)	Frequency (MHz)	Loss (dB)
30	0.7	250	1.8
40	0.7	300	2.1
50	0.9	400	2.3
60	0.9	500	2.5
70	0.9	600	3.0
80	0.9	700	3.4
90	1.1	800	3.6
100	1.1	900	3.9
150	1.4	1000	4.1
200	1.6	-	-

TABLE 5 : TEST CABLE FOR 3M MEASUREMENT INTO 30 MHz
AND 1 GHz

Frequency (GHz)	Antenna factor (dB/m)	Frequency (GHz)	Antenna factor (dB/m)
1.0	23.7	10.0	37.6
1.5	24.6	10.5	37.8
2.0	27.5	11.0	38.1
2.5	28.8	11.5	38.3
3.0	29.8	12.0	38.8
3.5	31.2	12.5	38.8
4.0	32.5	13.0	39.4
4.5	32.5	13.5	40.0
5.0	33.5	14.0	40.1
5.5	34.1	14.5	40.6
6.0	34.1	15.0	40.6
6.5	34.4	15.5	39.7
7.0	35.4	16.0	39.3
7.5	36.6	16.5	39.9
8.0	36.6	17.0	41.4
8.5	37.0	17.5	45.1
9.0	37.1	18.0	46.3
9.5	37.2		

TABLE 6 : HORN ANTENNA

Frequency (GHz)	Antenna factor (dB/m)	Frequency (GHz)	Antenna factor (dB/m)
18.0	31.5	22.5	32.7
18.5	31.8	23.0	33.2
19.0	31.9	23.5	33.1
19.5	32.1	24.0	33.2
20.0	32.2	24.5	33.3
20.5	32.4	25.0	33.3
21.0	32.5	25.5	33.2
21.5	32.4	26.0	33.1
22.0	32.4	-	-

TABLE 7 : HORN ANTENNA

Frequency (GHz)	Gain value (dB)	Frequency (GHz)	Gain value (dB)
1.0	34.9	13.0	32.3
1.5	34.8	14.0	32.1
2.0	35.1	15.0	33.0
2.5	35.1	16.0	33.5
3.0	35.3	17.0	33.5
4.0	35.7	18.0	33.7
5.0	36.0	19.0	33.7
6.0	36.2	20.0	32.5
7.0	35.5	21.0	33.0
8.0	34.8	22.0	33.0
9.0	33.2	23.0	33.0
9.5	31.9	24.0	34.3
10.0	31.3	25.0	33.2
10.5	31.1	26.0	32.0
11.0	30.9		
12.0	31.9		

TABLE 8 : AMPLIFIER GAIN VALUE

Frequency (GHz)	Loss (dB)	Frequency (GHz)	Loss (dB)
1.0	3.4	12.0	10.9
1.5	4.2	13.0	11.5
2.0	4.8	14.0	12.2
2.5	5.3	15.0	12.4
3.0	6.1	16.0	12.9
3.5	6.6	17.0	13.3
4.5	7.5	18.0	13.6
5	8.2	19.0	14.3
6	9.1	20.0	14.7
8	9.9	22.0	15.6
10	11.6	24.0	16.6
11.0	10.4	26.0	17.0

TABLE 9: TEST CABLE FOR 3M MEASUREMENT INTO 1 TO 26 GHz

ANNEX 2

External photographs





ANNEX 3

Test setup photographs







ANNEX 4

Calibration dates

N° EMITECH	LAST CALIBRATION	CALIBRATION DUE DATE
1216	12/12/2011	12/12/2013
0187	15/03/2013	15/03/2016
3106	27/04/2012	27/04/2014
2452	24/10/2012	24/10/2014
2805	01/08/2013	01/08/2015
10229	01/03/2012	01/03/2014
3374	08/02/2012	08/02/2016
2864	14/12/2011	14/12/2013
8063	06/08/2012	06/08/2014
1097	15/03/2013	15/03/2015
1529	15/03/2013	15/03/2015
4691	15/03/2013	15/03/2015
5175	27/03/2012	27/03/2014
9579	22/10/2012	22/10/2014
4359	07/03/2012	07/03/2014
0317	19/08/2010	19/08/2014
1045	13/12/2010	13/12/2014
3229	25/10/2012	25/12/2013
8021	22/02/2013	22/02/2015