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Compliance test report ID

236226TRFWL

Date of issue
June 19, 2013

FCC 47 CFR Part 15 Subpart C, §15.225

Operation within the band 13.110–14.010 MHz

Applicant	Technogym Spa
Product	NFC RFID
Model	NFC 12V Reader
Model variant	none
FCC ID	ZQWGIT000004

Test location

Nemko Spa a Socio Unico
Via del Carroccio, 4 20853 Biassono (MB) Italy

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FCC test site registration number: xxxxx (xxx m semi anechoic chamber)

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Tested by Daniele Guarnone



Reviewed by Gabriele Curioni



June 19, 2013

Date

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Italy's ISO/IEC 17025 accreditation.

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Section 1. Report summary

1.1 Applicant and manufacturer

Technogym Spa
Via G.Perticari, 20 - 47035 Gambettola FC - Italy

1.2 Test specifications

FCC 47 CFR Part 15, Subpart C, Clause 15.225 Operation in the 13.110–14.010 MHz

1.3 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See “Summary of test results” for full details.

1.4 Exclusions

None

1.5 Test report revision history

Revision #	Details of changes made to test report
TRF	Original report issued

Section 2. Summary of test results

2.1 FCC Part 15 Subpart C, general requirements test results

Part	Test description	Verdict
\$15.207(a)	Conducted limits	Pass
\$15.31(e)	Variation of power source	Pass ¹
\$15.203	Antenna requirement	Pass ²
\$15.215(c)	20 dB bandwidth	Pass

Notes: ¹ Measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, was performed with the supply voltage varied between 85 % and 115 % of the nominal rated supply voltage. No noticeable output power variation was observed

² The Antennas are located within the enclosure of EUT and not user accessible.

2.2 FCC Part 15 Subpart C, intentional radiator test results

Part	Test description	Verdict
\$15.225(a)	Field strength within 13.553–13.567 MHz band	Pass
\$15.225(b)	Field strength within 13.410–13.553 MHz and 13.567–13.710 MHz bands	Pass
\$15.225(c)	Field strength within 13.110–13.410 MHz and 13.710–14.010 MHz bands	Pass
\$15.225(d)	Field strength outside 13.110–14.010 MHz band	Pass
\$15.225(e)	Frequency tolerance of carrier signal	Pass

Notes: None

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	May 22, 2013
Nemko sample ID number	236226TRFWL

3.2 EUT information

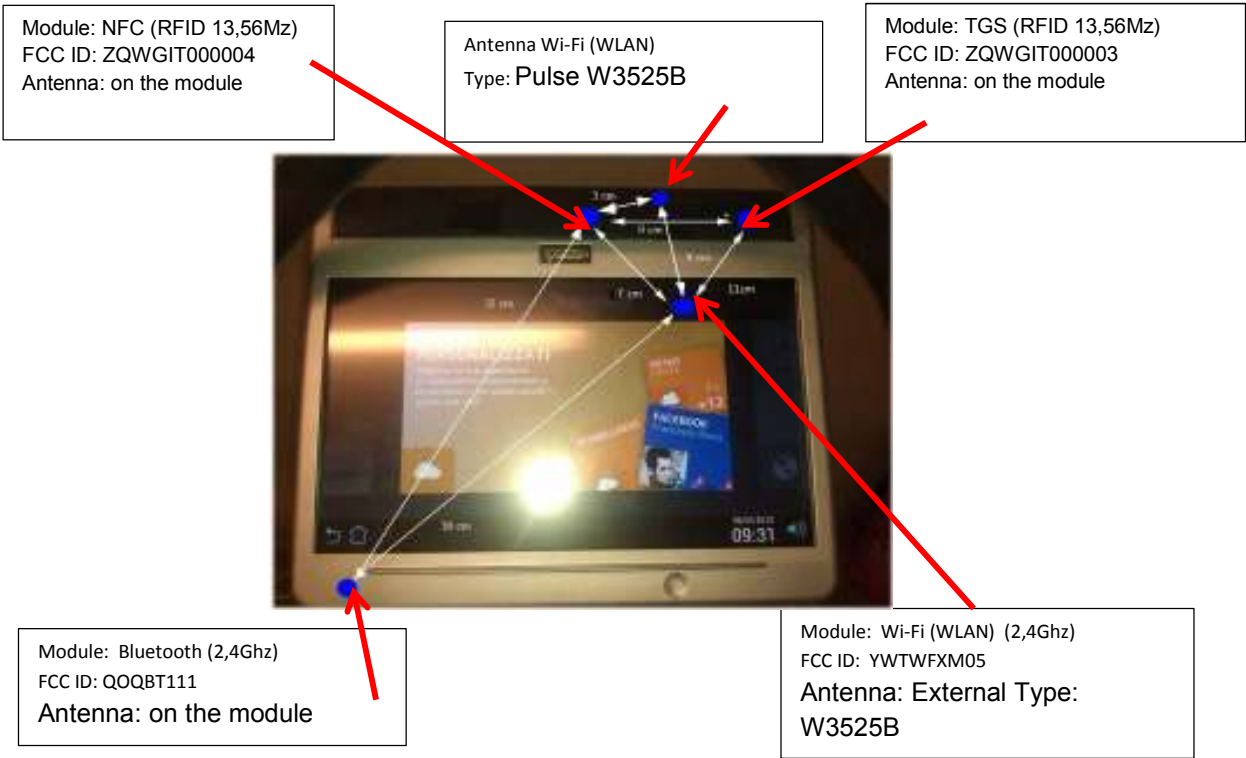
Product name	NFC RFID
Model	NFC 12V Reader
Model variant	none
Serial number	Not labeled

3.3 Technical information

Operating band	13.553–13.567MHz
Operating frequency	13.56 MHz
Modulation type	ASK
Occupied bandwidth (99 %)	0.953 MHz
Emission designator	953KA9D
Power requirements	110 Vac, 60 Hz
Antenna information	The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator.

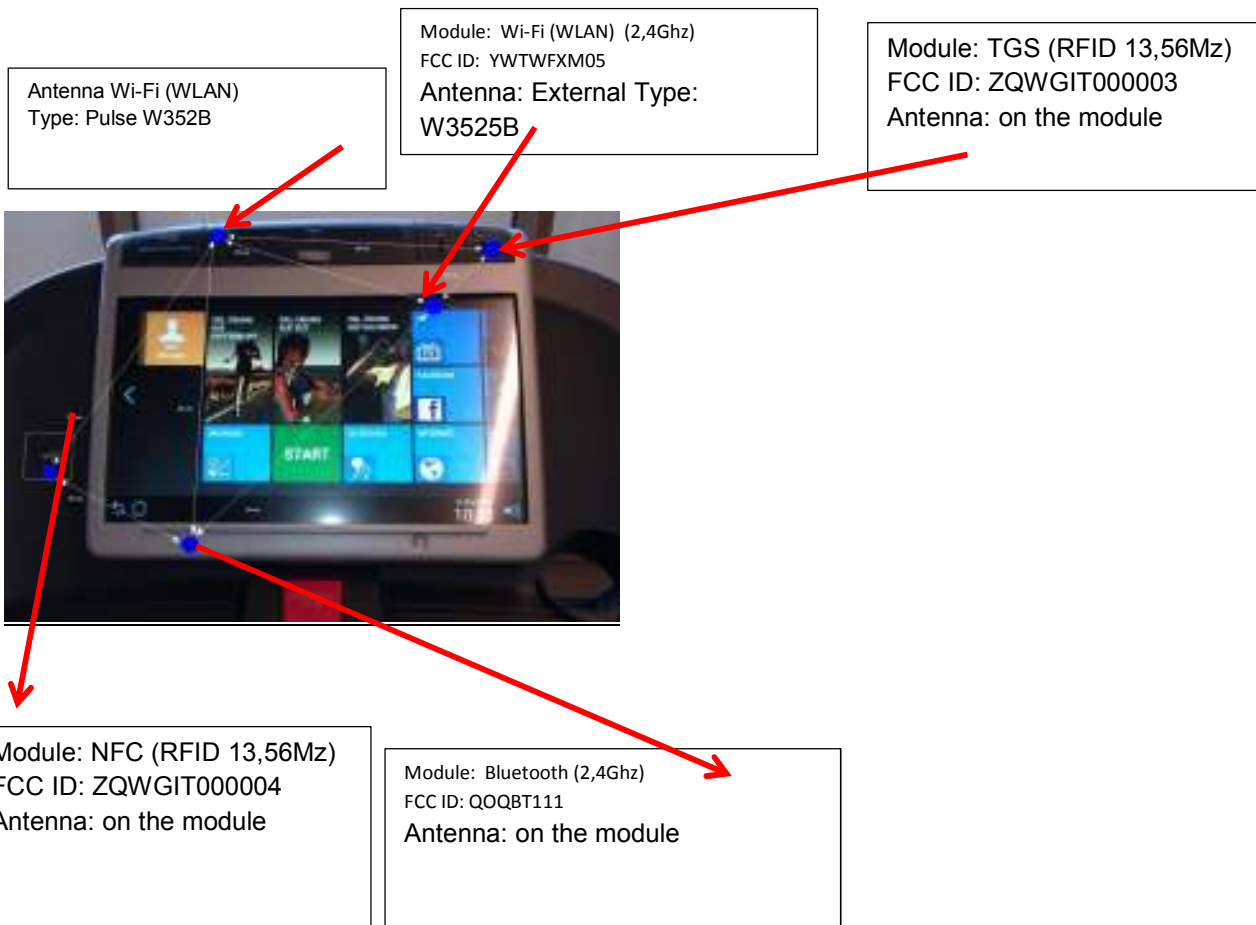
3.4 Product description and theory of operation

Visio Excite Small for Treadmill:



Operating conditions: Reading the tag continuously

Visio Excite BIG for Treadmill



Operating conditions: Reading the tag continuously

3.5 EUT exercise details

Equioment powered 110 Vac, 60 Hz; NFC RFID module reading Tag

3.6 EUT setup diagram

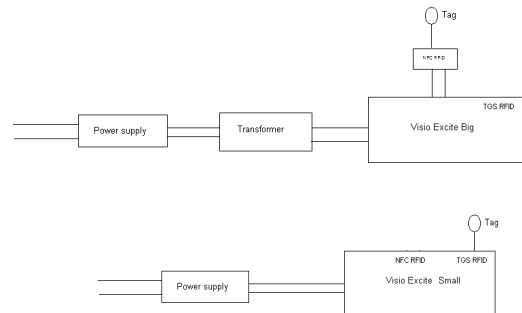


Figure3.6-1: Setup diagram

3.7 EUT sub assemblies

Table 3.7-1: EUT sub assemblies

Description	Brand name	Model/Part number	Serial number
Power supply	TGYM ALE-M	T0000017AA	32GM065522
Transformer	SACILE	ICES-EBM	T000008AA

Section 4. Engineering considerations

4.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

4.2 Technical judgment

None

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5. Test conditions

5.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	860–1060mbar

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages $\pm 5\%$, for which the equipment was designed.

Section 6. Measurement uncertainty

6.1 Uncertainty of measurement

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report according to CISPR 16-4-2 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements" and is documented in the Nemko Spa Technical Procedure WML1002. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device. Hereafter the best measurement capability for Nemko Spa laboratory is reported:

Section 7. Test equipment

7.1 Test equipment list

Table 7.1-1: Equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Emi Test Receiver	R&S	ESU8	100202		
Trilog Broadband Antenna	Schwarzbeck	VULB 9162	9162-025	1 year	2015/05
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	530	2 year	2014/08
Antenna mast	R&S	HCM	836 529/05	NCR	NCR
Controller	R&S	HCC	836 620/7	NCR	NCR
EMI receiver 9 kHz ÷ 3 GHz	R&S	ESCI	100888	2 year	2013/08
LISN 9 kHz ÷ 30 MHz	R&S	ESH2-Z5	872 460/041	2 year	2013/10
Climatic Chamber	ESPEC	ARS 1100	4100000067	2 year	2013/08
Loop antenna	R&S	HFH2-Z2	831247/011	2 year	2014/03

Note: NCR - no calibration required, VOU - verify on use

Section 8. Testing data

8.1 FCC 15.207(a) AC power line conducted emissions limits

8.1.1 Definitions and limits

Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

The conducted emissions shall be measured with a 50 Ω /50 μ H line impedance stabilization network (LISN).

Table 8.1-1: Conducted emissions limit

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

Note: * - Decreases with the logarithm of the frequency.

8.1.2 Test summary

Test date	June 17, 2013	Test engineer	Daniele Guarnone	Verdict	Pass
Temperature	24 °C	Air pressure	990 mbar	Relative humidity	50 %

8.1.3 Observations/special notes

The EUT was set up as tabletop configuration.

The spectral scan has been corrected with transducer factors (i.e. cable loss, LISN factors, and attenuators) for determination of compliance.

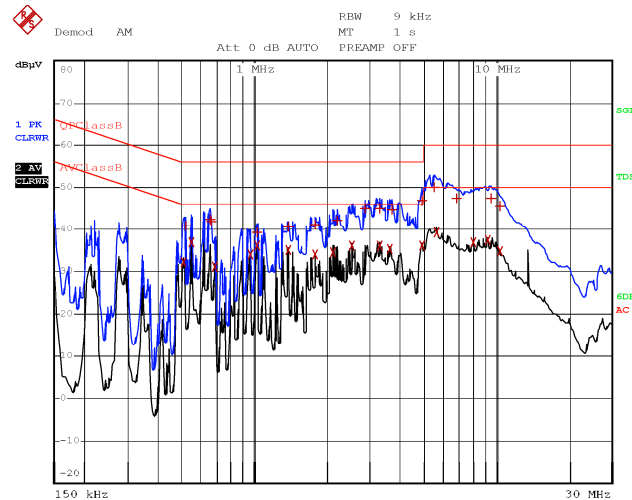
A preview measurement was generated with the receiver in continuous scan mode. Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Receiversettings forpreview measurements: Peak and Average detector (Max hold), RBW = 9 kHz, VBW = 30 kHz, Measurement time = 100 ms

Receiversettings forfinal measurements:Q-Peak and Average detector, RBW = 9 kHz, VBW = 30 kHz, Measurement time = 100 ms



8.1.4 Test data



Date: 28.MAY.2013 15:13:31

Plot 8.1-1: Conducted emissions on phase line Small

Table 8.1-2: Quasi-Peak conducted emissions results on phase line Small

Frequency MHz	Q-Peak result dBμV	Meas. Time,ms	Bandwidth kHz	Preamp	Correction, dB	Margin, dB	Limit, dBμV
0.6660	41.8	100	9	off	10.3	-14.2	56.0
1.0260	39.3	100	9	off	10.3	-16.7	56.0
1.3820	40.6	100	9	off	10.3	-15.4	56.0
1.7900	41.0	100	9	off	10.3	-15.0	56.0
2.2100	42.1	100	9	off	10.3	-13.9	56.0
2.8860	44.9	100	9	off	10.4	-11.1	56.0
3.3140	44.9	100	9	off	10.4	-11.1	56.0
3.7300	44.6	100	9	off	10.4	-11.4	56.0
4.9700	46.9	100	9	off	10.4	-9.1	56.0
5.5500	49.9	100	9	off	10.5	-6.1	56.0
6.8380	47.3	100	9	off	10.5	-8.7	56.0
9.4980	47.2	100	9	off	10.6	-12.8	60.0
10.4060	45.5	100	9	off	10.6	-14.5	60.0

Sample calculation:

Correction factor (dB) = LISN factor IL (dB) + cable loss (dB) + attenuator (dB)

Result (dBμV) = XX dBμV (reading from receiver) + XX dB (Correction factor)

Example:

43.5 dBμV = 23.2 dBμV (receiver reading) + 10.1 dB (LISN factor IL) + 0.2 dB (cable loss) + 10 dB (attenuator)

Section 8
Test name
Specification

Testing data
FCC 15.207(a) AC power line conducted emissions limits
FCC Part 15 Subpart C



Table 8.1-3: Average conducted emissions results on phase line Small

Frequency MHz	Average result dBµV	Meas. Time,ms	Bandwidth kHz	Preamp	Correction, dB	Margin, dB	Limit, dBµV
0.5100	32.0	100	9	off	10.4	-14.0	46.0
0.5500	36.7	100	9	off	10.4	-9.3	46.0
0.6860	31.2	100	9	off	10.3	-14.8	46.0
0.9620	34.0	100	9	off	10.3	-12.0	46.0
1.0300	36.1	100	9	off	10.3	-9.9	46.0
1.3780	35.0	100	9	off	10.3	-11.0	46.0
1.7900	34.1	100	9	off	10.3	-11.9	46.0
2.1260	34.4	100	9	off	10.3	-11.6	46.0
2.5460	36.1	100	9	off	10.4	-9.9	46.0
3.3060	35.9	100	9	off	10.4	-10.1	46.0
3.6500	35.2	100	9	off	10.4	-10.8	46.0
4.9660	36.0	100	9	off	10.4	-10.0	46.0
5.6580	39.2	100	9	off	10.5	-10.8	50.0
8.0780	36.8	100	9	off	10.5	-13.2	50.0
9.2500	37.4	100	9	off	10.6	-12.6	50.0
10.4260	34.7	100	9	off	10.6	-15.3	50.0

Sample calculation:

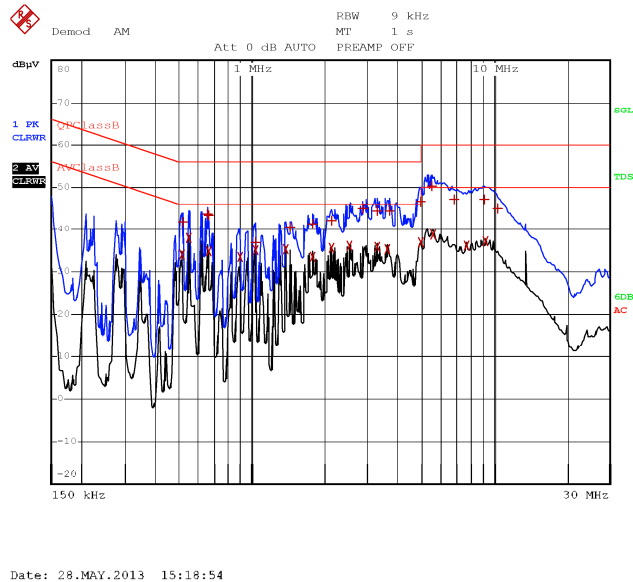
Correction factor (dB) = LISN factor IL (dB) + cable loss (dB) + attenuator (dB)

Result (dBµV) = XX dBµV (reading from receiver) + XX dB (Correction factor)

Example:

43.5 dBµV = 23.2 dBµV (receiver reading) + 10.1 dB (LISN factor IL) + 0.2 dB (cable loss) + 10 dB (attenuator)

8.1.4 Test data, continued



Plot 8.1-2: Conducted emissions on neutral line Small

Table 8.1-4: Quasi-Peak conducted emissions resultson neutral line Small

Frequency MHz	Q-Peak result dBμV	Meas. Time,ms	Bandwidth kHz	Preamplifier	Correction, dB	Margin, dB	Limit, dBμV
0.5180	41.7	100	9	off	10.4	-14.3	56.0
0.6580	43.6	100	9	off	10.3	-12.4	56.0
0.6620	43.3	100	9	off	10.3	-12.7	56.0
1.0420	36.9	100	9	off	10.3	-19.1	56.0
1.4500	40.5	100	9	off	10.3	-15.5	56.0
1.7900	41.2	100	9	off	10.3	-14.8	56.0
2.1380	42.1	100	9	off	10.3	-13.9	56.0
2.8820	45.1	100	9	off	10.4	-10.9	56.0
3.3140	44.4	100	9	off	10.4	-11.6	56.0
3.7340	44.5	100	9	off	10.4	-11.5	56.0
4.9820	46.5	100	9	off	10.4	-9.5	56.0
5.5540	50.3	100	9	off	10.5	-9.7	60.0
6.8420	47.1	100	9	off	10.5	-12.9	60.0
9.1700	47.2	100	9	off	10.6	-12.8	60.0
10.4140	45.0	100	9	off	10.6	-15.0	60.0

Note: 43.5 dBμV = 23.2 dBμV (receiver reading) + 10.1 dB (LISN factor IL) + 0.2 dB (cable loss) + 10 dB (attenuator)

Table 8.1-5: Average conducted emissions results on neutral line small

Frequency MHz	Average result dBμV	Meas. Time,ms	Bandwidth kHz	Preamp	Correction, dB	Margin, dB	Limit, dBμV
0.5140	34.0	100	9	off	10.4	-12.0	46.0
0.5500	38.0	100	9	off	10.4	-8.0	46.0
0.6620	34.7	100	9	off	10.3	-11.3	46.0
0.8940	33.4	100	9	off	10.3	-12.6	46.0
1.0340	35.1	100	9	off	10.3	-10.9	46.0
1.3780	35.1	100	9	off	10.3	-10.9	46.0
1.7860	33.3	100	9	off	10.3	-12.7	46.0
2.1300	35.5	100	9	off	10.3	-10.5	46.0
2.5420	36.1	100	9	off	10.4	-9.9	46.0
3.3100	35.9	100	9	off	10.4	-10.1	46.0
3.6500	35.1	100	9	off	10.4	-10.9	46.0
4.9780	36.7	100	9	off	10.4	-9.3	46.0
5.6300	38.6	100	9	off	10.5	-11.4	50.0
7.7460	36.1	100	9	off	10.5	-13.9	50.0
9.2540	37.2	100	9	off	10.6	-12.8	50.0

Sample calculation:

Correction factor (dB) = LISN factor IL (dB) + cable loss (dB) + attenuator (dB)

Result (dBμV) = XX dBμV (reading from receiver) + XX dB (Correction factor)

Example:

dBμV = 23.2 dBμV (receiver reading) + 10.1 dB (LISN factor IL) + 0.2 dB (cable loss) + 10 dB (attenuator)

Table 8.1-7: Average conducted emissions results on phase line Big

Frequency MHz	Average result dBμV	Meas. Time ms	Bandwidth kHz	Preamp	Correction, dB	Margin, dB	Limit, dBμV
0.17800	48.1	100	9	off	11.5	-6.5	54.6
0.23800	41.5	100	9	off	11.0	-10.7	52.2
8.15400	36.0	100	9	off	10.5	-14.0	50.0
8.51400	34.9	100	9	off	10.5	-15.1	50.0
13.56200	47.9	100	9	off	10.7	-2.1	50.0
19.05000	39.7	100	9	off	10.9	-10.3	50.0
20.06200	38.9	100	9	off	11.0	-11.1	50.0

Sample calculation:

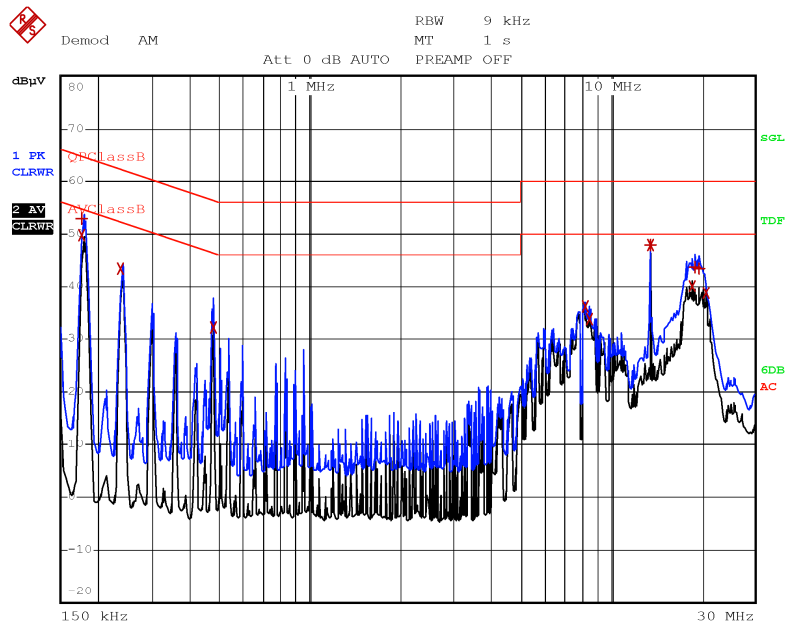
Correction factor (dB) = LISN factor IL (dB) + cable loss (dB) + attenuator (dB)

Result (dBμV) = XX dBμV (reading from receiver) + XX dB (Correction factor)

Example:

dBμV = 23.2 dBμV (receiver reading) + 10.1 dB (LISN factor IL) + 0.2 dB (cable loss) + 10 dB (attenuator)

8.4.1 Test data, continued



Date: 17.JUN.2013 15:48:05

Plot 8.1-4: Conducted emissions on neutral line Big

Table 8.1-8: Quasi-Peak conducted emissions results on neutral line Big

Frequency MHz	Q-Peak result dBμV	Meas. Time ms	Bandwidth kHz	Preamp	Correction, dB	Margin, dB	Limit, dBμV
0.17800	53.0	100	9	off	11.5	-11.6	64.6
13.56200	47.8	100	9	off	10.7	-12.2	60.0
18.99000	43.7	100	9	off	10.9	-16.3	60.0
19.70600	43.3	100	9	off	10.9	-16.7	60.0

Sample calculation:

Correction factor (dB) = LISN factor IL (dB) + cable loss (dB) + attenuator (dB)

Result (dBμV) = XX dBμV (reading from receiver) + XX dB (Correction factor)

Example:

dBμV = 23.2 dBμV (receiver reading) + 10.1 dB (LISN factor IL) + 0.2 dB (cable loss) + 10 dB (attenuator)

Table 8.1-9: Average conducted emissions result on neutral line Big

Frequency MHz	Average result dBµV	Meas. Time ms	Bandwidth kHz	Preamp	Correction, dB	Margin, dB	Limit, dBµV
0.17800	49.7	100	9	off	11.5	-4.8	54.6
0.23800	43.5	100	9	off	11.0	-8.7	52.2
0.47800	32.0	100	9	off	10.4	-14.3	46.4
8.21400	36.0	100	9	off	10.5	-14.0	50.0
8.45400	33.8	100	9	off	10.5	-16.2	50.0
13.56200	47.8	100	9	off	10.7	-2.2	50.0
18.63400	39.9	100	9	off	10.9	-10.1	50.0
20.59800	38.7	100	9	off	11.0	-11.3	50.0

Sample calculation:

Correction factor (dB) = LISN factor IL (dB) + cable loss (dB) + attenuator (dB)

Result (dBµV) = XX dBµV (reading from receiver) + XX dB (Correction factor)

Example:

43.5 dBµV = 23.2 dBµV (receiver reading) + 10.1 dB (LISN factor IL) + 0.2 dB (cable loss) + 10 dB (attenuator)

8.2 FCC15.215(c) 20 dB bandwidth

8.2.1 Definitions and limits

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage.

8.2.2 Test summary

Test date	May 27, 2013	Test engineer	Daniele Guarnone	Verdict	Pass
Temperature	24 °C	Air pressure	990 mbar	Relative humidity	50 %

8.2.3 Observations/special notes

Measurements were performed with peak detector using RBW of at least 1 % of span. VBW was set three times RBW.

8.2.4 Test data

Table 8.2-1: Lower 20 dBc frequency cross result

Fundamental frequency, MHz	Lower 20 dBc frequency cross, MHz	Limit, MHz	Margin, MHz
13.560	13.342	13.110	0.232
13.560	13.342	13.110	0.232

Table 8.2-2: Upper 20 dBc frequency cross result

Fundamental frequency, MHz	Upper 20 dBc frequency cross, MHz	Limit, MHz	Margin, MHz
13.560	13.781	14.010	0.229
13.560	13.779	14.010	0.231

Table 8.2-3: 99 % occupied bandwidth result

Frequency, MHz	99 % occupied bandwidth, MHz
13.56	0.622
13.56	0.572



8.2.4 Test data, continued

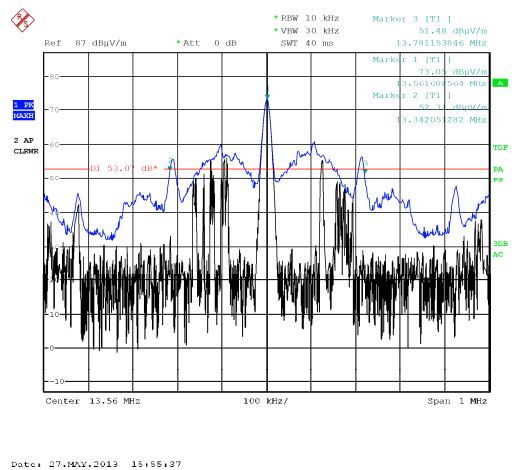


Figure8.2-1: 20dBbandwidth spectrum plot (Small configuration)

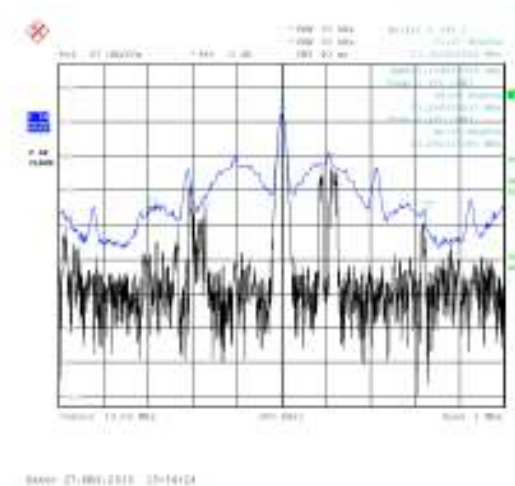


Figure8.2-2: 99 % occupied bandwidth spectrum plot (Small Configuration)

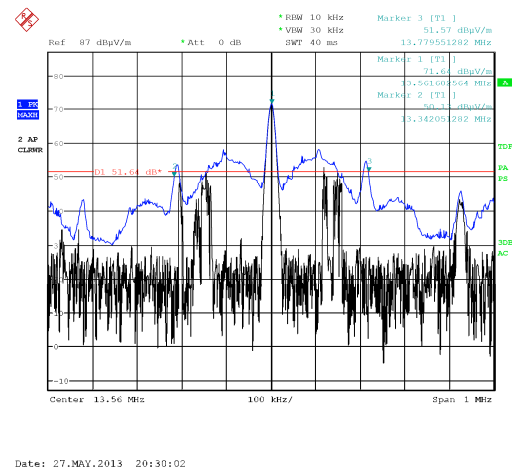


Figure8.2-33: 20 dBbandwidth spectrum plot (Big Configuration)

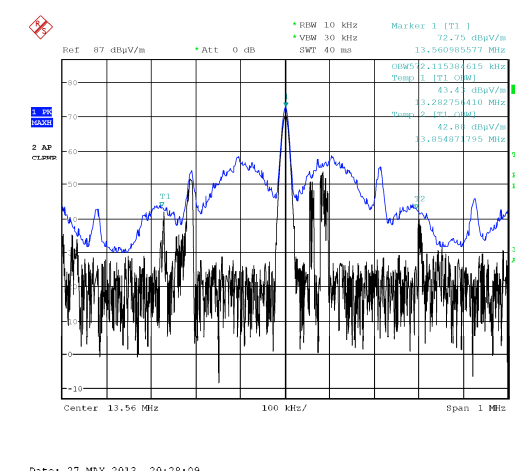


Figure8.2-44: 99 % occupied bandwidth spectrum plot (Big Configuration)

8.3 FCC15.225(a–c) Field strength within the 13.110–14.010 MHz band

8.3.1 Definitions and limits

- a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15848 $\mu\text{V/m}$ (84 dB $\mu\text{V/m}$) at 30 m.
- b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 $\mu\text{V/m}$ (50.5 dB $\mu\text{V/m}$) at 30 m.
- c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 $\mu\text{V/m}$ (40.5 dB $\mu\text{V/m}$) at 30 m.

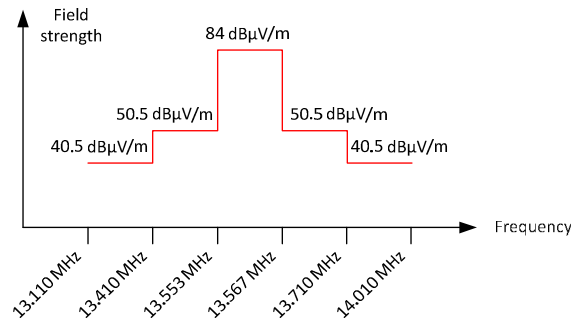


Figure 8.3-1: In-band spurious emissions limit

8.3.2 Test summary

Test date	May 27, 2013	Test engineer	Daniele Guarnone	Verdict	Pass
Temperature	25 °C	Air pressure	990 mbar	Relative humidity	50 %

8.3.3 Observations/special notes

The measurements were performed using peak detector with 10 kHz RBW at the distance of 3 m.
 40 dB distance correction factor* was applied to the measurement result in order to comply with 30 m limits.
 The EUT was measured on three orthogonal axis and was rotated 360°

* 30 m to 3 m distance correction factor calculation (for 13 MHz band):
 $40 \times \log_{10} (3 \text{ m}/30 \text{ m}) = 40 \times \log_{10} (0.1) = -40 \text{ dB}$

8.3.4 Test data

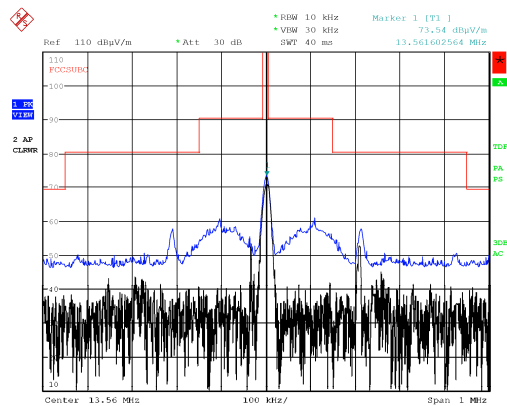
Table 8.3-1: Output power measurements and EIRP calculations results

Frequency, MHz	Field strength at 3 m, dB $\mu\text{V/m}$	Calculated field strength at 30 m, dB $\mu\text{V/m}$	Limit, dB $\mu\text{V/m}$	Margin, dB
13.56 (Small)	73.5	33.5	84	50.5
13.56 (Big)	73.1	33.1	84	50.9

Note: Calculated field strength at 30 m = Measured field strength at 3 m – 40 dB

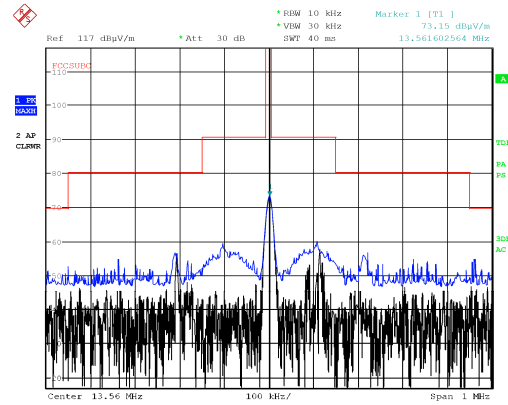


8.3.4 Test data, continued



Date: 27.MAY.2013 16:05:45

Figure8.3-2: Field strength measurement spectrum plot within 13.110–14.01MHz band Small



Date: 27.MAY.2013 20:32:32

Figure8.3-3: Field strength measurement spectrum plot within 13.110–14.01band Big

8.4 FCC15.225(d) Field strength of emissions outside 13.110–14.010 MHz band

8.4.1 Definitions and limits

The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in §15.209
The field strength of emissions appearing within restricted bands (as specified in §15.205) shall not exceed the limits from §15.209

Table 8.4-1: FCC §15.209– Radiated emission limits

Frequency, MHz	Field strength of emissions		Measurement distance, m
	$\mu\text{V/m}$	$\text{dB}\mu\text{V/m}$	
0.009–0.490	2400/F	$67.6 - 20 \times \log_{10}(F)$	300
0.490–1.705	24000/F	$87.6 - 20 \times \log_{10}(F)$	30
1.705–30.0	30	29.5	30
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

Notes: In the emission table above, the tighter limit applies at the band edges. For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test

Table 8.4-2: Restricted frequency bands

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	Above 38.6
13.36–13.41			

8.4.2 Test summary

Test date	May 27, 2013	Test engineer	Daniele Guarnone	Verdict	Pass
Temperature	24 °C	Air pressure	990 mbar	Relative humidity	50 %

8.4.3 Observations/special notes

The spectrum was searched from 9 kHz to 1 GHz.
Radiated measurements were performed at a distance of 3 m.
Measurements below 30 MHz were performed using a quasi-peak detector with 9 kHz/30 kHz RBW/VBW
For frequencies below 1 GHz, RBW was set to 100 kHz, VBW was 3 times wider than RBW.
For frequencies within 30–1000 MHz range: using a peak detector with 100 kHz/300 kHz RBW/VBW

8.4.4 Test data

Duty cycle/average factor calculations

§15.35(c) When the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.

Duty cycle/average factor calculation: $DC-CF = 20 \times \log_{10} (TX_{100\text{ ms}} \div 100\text{ ms})$

Small Configuration

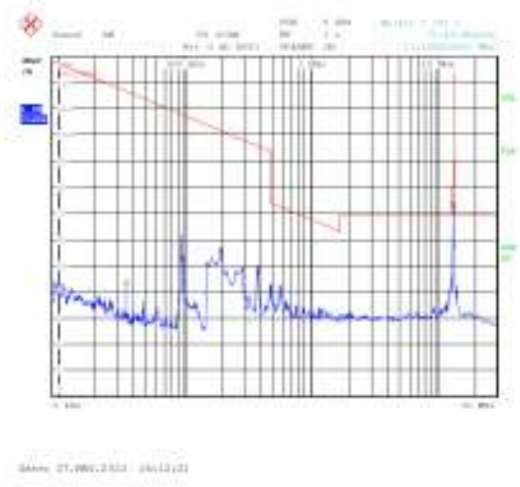


Figure 8.4-1: Field strength of spurious emissions within 9 kHz 30 MHz band small

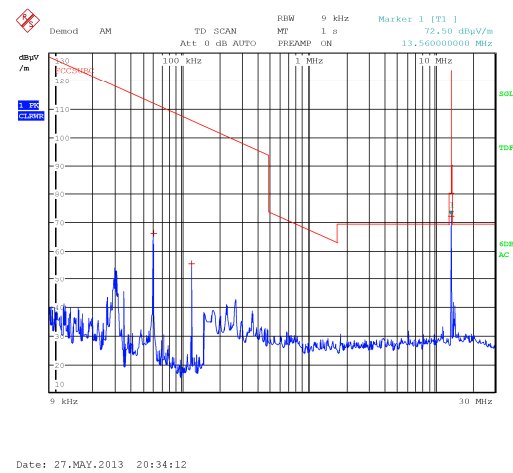


Figure 8.4-2: Field strength of spurious emissions within 9kHz 30 MHz band Big

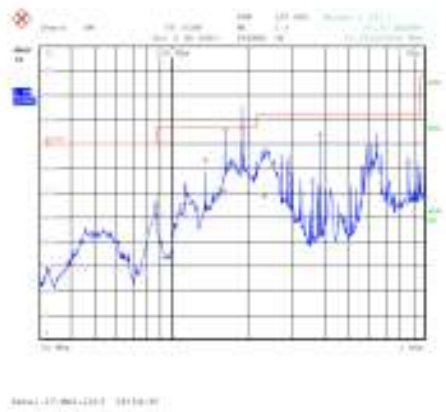


Figure 8.4-3: Field strength of spurious emissions within 30-1000 MHz band Small, horizontal polarization

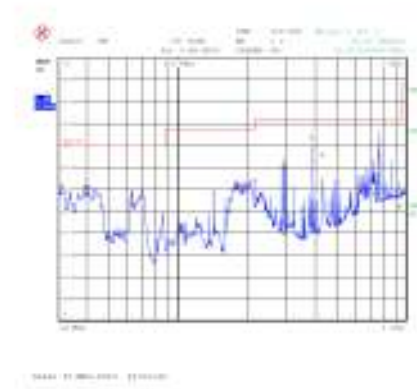


Figure 8.4-4: Field strength of spurious emissions within 30-1000 MHz band Small, vertical polarization

Section 8	Testing data
Test name	FCC15.225(d) Field strength of emissions outside 13.110–14.010 MHz band
Specification	FCC Part 15 Subpart C



8.4.4 Test data, continue

Duty cycle/average factor calculations

§15.35(c) When the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.

Duty cycle/average factor calculation: $DC-CF = 20 \times \log_{10} (T_{x100\text{ ms}} \div 100\text{ ms})$

Big Configuration

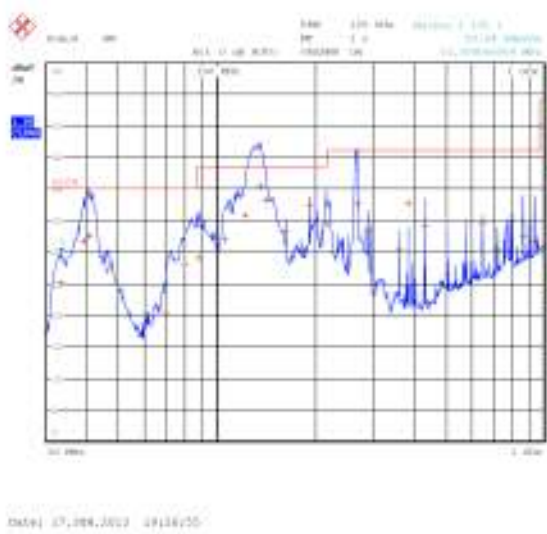


Figure8.4-5: Field strength of spurious emissions within 30 1000 MHz band Big, horizontal polarization

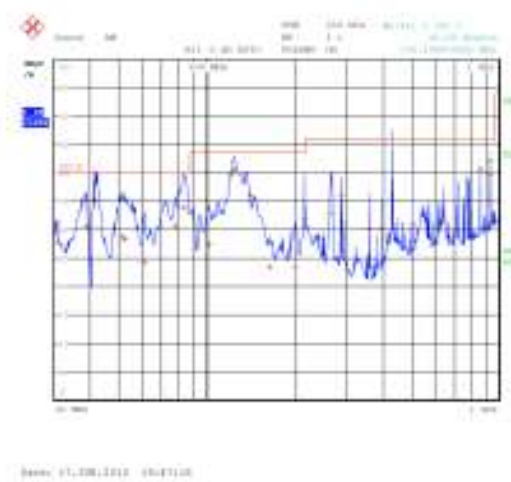


Figure8.4-6: Field strength of spurious emissions within 30 1000 MHz band Big, vertical polarization

Section 8
Test name
Specification

Testing data
 FCC15.225(d) Field strength of emissions outside 13.110–14.010 MHz band
 FCC Part 15 Subpart C



Table 8.4-3: Radiated emission Small

Frequency MHz	Q-Peak result dBµV/m	Meas. Time ms	Bandwidth, Hz	Preamp	Correction, dB	Margin, dB	Limit, dBµV/m
0.0347	43.2	100	0.2	on	20.0	-73.6	116.8
0.0954	52.7	100	0.2	on	20.1	-55.3	108.0
0.1925	55.9	100	9	on	20.1	-46.0	101.9
0.3825	48.2	100	9	on	20.1	-47.8	96.0
13.5600	72.1	100	9	on	20.6	-51.9	124.0

Sample calculation:

Correction factor (dB) = Antenna factor (dB) + cable loss (dB)

Result (dBµV/m) = XX dBµV (reading from receiver) + XX dB (Correction factor)

Example:

43.5 dBµV = 23.2 dBµV (receiver reading) + correction factor

Table 8.4-4: Radiated emission Big

Frequency MHz	Q-Peak result dBµV/m	Meas. Time ms	Bandwidth kHz	Preamp	Correction, dB	Margin, dB	Limit, dBµV/m
0.0597	66.2	100	0.2	on	20.0	-45.9	112.1
0.1191	55.4	100	0.2	on	20.1	-50.7	106.1
13.5600	72.2	100	9	on	20.6	-51.8	124.0

Sample calculation:

Correction factor (dB) = Antenna factor (dB) + cable loss (dB)

Result (dBµV/m) = XX dBµV (reading from receiver) + XX dB (Correction factor)

Example:

43.5 dBµV = 23.2 dBµV (receiver reading) + correction factor

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Table 8.4-5: Radiated emission Big 30 MHz 1000 MHz vertical

Frequency MHz	Q-Peak result dBμV/m	Meas. Time ms	Bandwidth kHz	Preamp	Correction, dB	Margin, dB	Limit, dBμV/m
30.62500	27.6	15	120	on	11.6	-12.4	40.0
38.57500	30.6	15	120	on	13.1	-9.4	40.0
41.30000	35.2	15	120	on	13.7	-4.8	40.0
51.42500	28.6	15	120	on	14.4	-11.4	40.0
52.65000	28.4	15	120	on	14.3	-11.6	40.0
60.87500	24.1	15	120	on	13.1	-15.9	40.0
78.10000	30.7	15	120	on	8.3	-9.3	40.0
83.55000	33.8	15	120	on	8.9	-6.2	40.0
101.40000	27.3	15	120	on	12.3	-16.2	43.5
121.67500	39.6	15	120	on	10.0	-3.9	43.5
123.67500	40.7	15	120	on	9.7	-2.8	43.5
140.57500	36.2	15	120	on	8.4	-7.4	43.5
163.55000	23.4	15	120	on	8.9	-20.2	43.5
200.10000	23.4	15	120	on	11.1	-20.1	43.5
215.97500	31.9	15	120	on	11.3	-11.6	43.5
267.90000	32.9	15	120	on	12.6	-13.1	46.0
288.00000	35.9	15	120	on	12.8	-10.1	46.0
359.95000	30.2	15	120	on	14.3	-15.8	46.0
396.02500	30.1	15	120	on	14.9	-15.9	46.0
432.00000	44.9	15	120	on	15.3	-1.1	46.0
503.97500	31.1	15	120	on	16.4	-14.9	46.0
648.05000	31.5	15	120	on	18.4	-14.6	46.0
720.05000	29.8	15	120	on	19.5	-16.2	46.0
864.05000	40.6	15	120	on	21.2	-5.4	46.0
936.10000	39.7	15	120	on	21.6	-6.3	46.0

Sample calculation:

Correction factor (dB) = Antenna factor (dB) + cable loss (dB)

Result (dBμV/m) = XX dBμV (reading from receiver) + XX dB (Correction factor)

Example:

43.5 dBμV = 23.2 dBμV (receiver reading) + correction factor

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FCC15.225(d) Field strength of emissions outside 13.110–14.010 MHz band
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Table 8.4-6: Radiated emission Big 30 MHz 1000 MHz horizontal

Frequency MHz	Q-Peak result dBμV/m	Meas. Time ms	Bandwidth kHz	Preamp	Correction, dB	Margin, dB	Limit, dBμV/m
33.30000	25.0	15	120	on	11.8	-15.0	40.0
39.05000	31.7	15	120	on	13.2	-8.3	40.0
40.35000	32.6	15	120	on	13.5	-7.4	40.0
46.00000	27.1	15	120	on	14.4	-12.9	40.0
69.55000	20.5	15	120	on	10.3	-19.5	40.0
79.92500	27.9	15	120	on	8.2	-12.1	40.0
87.52500	29.0	15	120	on	9.8	-11.0	40.0
105.90000	32.0	15	120	on	12.3	-11.5	43.5
121.85000	35.9	15	120	on	9.9	-7.7	43.5
135.62500	40.4	15	120	on	8.7	-3.1	43.5
140.40000	38.2	15	120	on	8.4	-5.3	43.5
162.00000	33.2	15	120	on	8.8	-10.3	43.5
192.00000	37.3	15	120	on	10.7	-6.2	43.5
215.92500	34.4	15	120	on	11.3	-9.2	43.5
267.80000	37.6	15	120	on	12.6	-8.4	46.0
288.02500	33.3	15	120	on	12.8	-12.8	46.0
360.05000	30.4	15	120	on	14.4	-15.6	46.0
384.02500	37.6	15	120	on	14.7	-8.4	46.0
431.97500	34.2	15	120	on	15.3	-11.8	46.0
503.92500	26.5	15	120	on	16.4	-19.5	46.0
648.02500	34.6	15	120	on	18.4	-11.4	46.0
719.97500	30.5	15	120	on	19.5	-15.5	46.0
864.02500	32.4	15	120	on	21.2	-13.6	46.0
936.02500	31.7	15	120	on	21.6	-14.4	46.0

Sample calculation:

Correction factor (dB) = Antenna factor (dB) + cable loss (dB)

Result (dBμV/m) = XX dBμV (reading from receiver) + XX dB (Correction factor)

Example:

43.5 dBμV = 23.2 dBμV (receiver reading) + correction factor

Section 8
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Table 8.4-7: Radiated emission Small 30 1000 v

Frequency MHz	Qp result dBμV/m	Meas. Time ms	Bandwidth kHz	Filter	Correction, dB	Margin, dB	Limit, dBμV/m
31.0750	31.0	15	120	on	25.1	-9.0	40.0
35.0750	31.0	15	120	on	26.2	-9.0	40.0
45.1000	29.7	15	120	on	30.8	-10.3	40.0
46.5500	29.9	15	120	on	31.2	-10.1	40.0
64.2000	23.5	15	120	on	27.3	-16.5	40.0
79.9750	24.6	15	120	on	19.5	-15.4	40.0
80.9750	25.5	15	120	on	19.8	-14.5	40.0
105.4000	27.0	15	120	on	28.2	-16.5	43.5
106.4250	26.3	15	120	on	28.1	-17.2	43.5
144.0000	27.7	15	120	on	20.6	-15.8	43.5
162.0000	32.3	15	120	on	21.7	-11.2	43.5
192.1000	25.2	15	120	on	25.9	-18.3	43.5
215.9750	38.6	15	120	on	27.2	-4.9	43.5
252.0250	31.5	15	120	on	29.9	-14.5	46.0
288.0000	36.7	15	120	on	31.3	-9.3	46.0
360.0000	36.8	15	120	on	35.1	-9.2	46.0
384.0250	40.7	15	120	on	36.0	-5.3	46.0
432.0000	32.0	15	120	on	37.7	-14.0	46.0
503.8500	30.1	15	120	on	40.4	-15.9	46.0
720.0250	32.0	15	120	on	48.1	-14.0	46.0
768.0500	37.1	15	120	on	49.4	-8.9	46.0
936.2000	29.5	15	120	on	53.8	-16.5	46.0

Sample calculation:

Correction factor (dB) = Antenna factor (dB) + cable loss (dB)

Result (dBμV/m) = XX dBμV (reading from receiver) + XX dB (Correction factor)

Example:

43.5 dBμV = 23.2 dBμV (receiver reading) + factor

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Table 8.4-8: Radiated emission small 30 1000 MHz horizontal

Frequency MHz	QP result dBμV/m	Meas. Time ms	Bandwidth kHz	Filter	Correction, dB	Margin, dB	Limit, dBμV/m
59.6000	21.8	15	120	on	14.7	-18.2	40.0
60.6000	22.0	15	120	on	14.5	-18.0	40.0
81.0000	22.6	15	120	on	9.9	-17.4	40.0
135.0000	43.2	15	120	on	10.6	-0.3	43.5
160.0000	34.0	15	120	on	10.8	-9.5	43.5
162.0250	42.8	15	120	on	10.8	-0.7	43.5
189.0000	42.9	15	120	on	12.7	-0.6	43.5
215.9750	34.7	15	120	on	13.6	-8.8	43.5
252.0250	28.5	15	120	on	14.9	-17.5	46.0
384.0250	32.9	15	120	on	18.0	-13.1	46.0
648.0500	32.9	15	120	on	22.7	-13.1	46.0
675.0250	35.2	15	120	on	23.3	-10.8	46.0
768.0250	30.7	15	120	on	24.7	-15.3	46.0
935.9500	27.1	15	120	on	26.9	-18.9	46.0

Sample calculation:

Correction factor (dB) = Antenna factor (dB) + cable loss (dB)

Result (dBμV/m) = XX dBμV (reading from receiver) + XX dB (Correction factor)

Example:

43.5 dBμV = 23.2 dBμV (receiver reading) + factor

8.5 FCC15.225(e) Frequency tolerance of the carrier signal

8.5.1 Definitions and limits

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

8.5.2 Test summary

Test date	May 30, 2013	Test engineer	Daniele Guarnone	Verdict	Pass
Temperature	24 °C	Air pressure	990 mbar	Relative humidity	50 %

8.5.3 Observations/special notes

The test was performed using peak detector of the spectrum analyzer with RBW no narrower than 1 % of the emission bandwidth.

8.5.4 Test data

Table 8.5-1: Frequency drift measurements results small

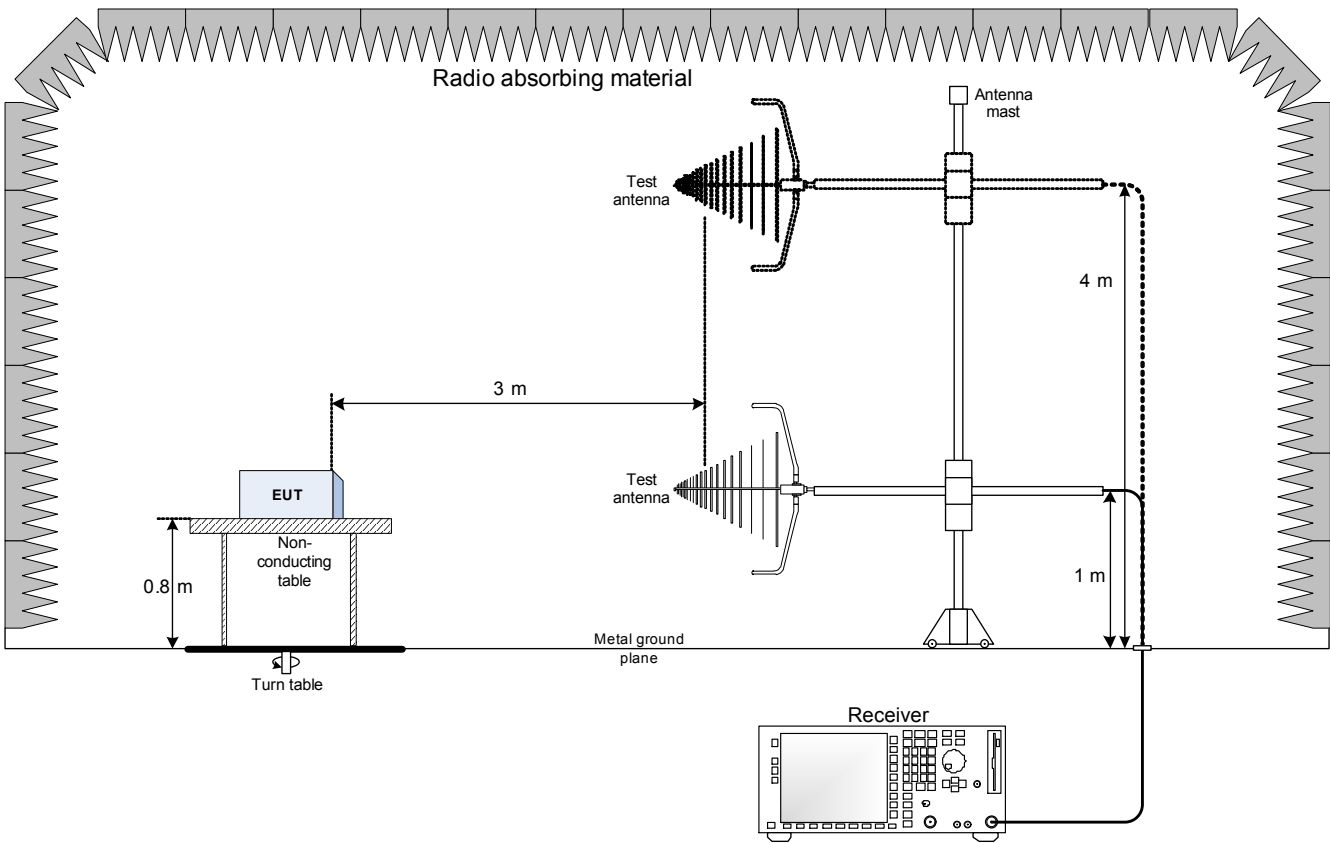
Test conditions	Frequency, MHz	Frequency drift, MHz	Frequency drift, %	Limit, $\pm\%$	Margin, %
+50 °C, Nominal	13.56126754	0.00020041	0.001477834	0.01	0.0085222
+40 °C, Nominal	13.56121743	0.00015030	0.00110832	0.01	0.0088917
+30 °C, Nominal	13.56121743	0.00015030	0.00110832	0.01	0.0088917
+20 °C, +15 %	13.56126754	0.00020041	0.001477834	0.01	0.0085222
+20 °C, Nominal	13.56106713	Reference	Reference	Reference	Reference
+20 °C, -15 %	13.56121743	0.00015030	0.00110832	0.01	0.0088917
+10 °C, Nominal	13.56126754	0.00020041	0.001477834	0.01	0.0085222
0 °C, Nominal	13.56114228	0.00007515	0.00055416	0.01	0.0094458
-10 °C, Nominal	13.56116733	0.00010020	0.00073888	0.01	0.0092611
-20 °C, Nominal	13.56114228	0.00007515	0.00055416	0.01	0.0094458

Table 8.5-2: Frequency drift measurements results big

Test conditions	Frequency, MHz	Frequency drift, MHz	Frequency drift, %	Limit, $\pm\%$	Margin, %
+50 °C, Nominal	13.56104208	-0.00005010	-0.00036944	0.01	0.0103694
+40 °C, Nominal	13.56106713	-0.00002505	-0.00018472	0.01	0.0101847
+30 °C, Nominal	13.56106713	-0.00002505	-0.00018472	0.01	0.0101847
+20 °C, +15 %	13.56111723	0.00002505	0.00018472	0.01	0.0098153
+20 °C, Nominal	13.56109218	Reference	Reference	Reference	Reference
+20 °C, -15 %	13.56111723	0.00002505	0.00018472	0.01	0.0098153
+10 °C, Nominal	13.56111723	0.00002505	0.00018472	0.01	0.0098153
0 °C, Nominal	13.56109218	0.00000000	0	0.01	0.01
-10 °C, Nominal	13.56109218	0.00000000	0	0.01	0.01
-20 °C, Nominal	13.56109218	0.00000000	0	0.01	0.01

Section 9. Block diagrams of test set-ups

9.1 Radiated emissions set-up



9.2 Conducted emissions set-up

