



**Nemko**

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Compliance test report ID

**236226TRFWL**

Date of issue  
June 19, 2013

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**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    ZQWG1T000004

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Test location

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

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

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**Tested by** Daniele Guarnone 

Reviewed by Gabriele Curioni 

June 19, 2013

**Date**

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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 contained in this report are within Nemko Italy's ISO/IEC 17025 accreditation.

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## Section 1. Report summary

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### 1.1 Applicant and manufacturer

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

### 1.2 Test specifications

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

### 1.3 Statement of compliance

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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

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None

### 1.5 Test report revision history

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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 <sup>1</sup>
§15.203	Antenna requirement	Pass <sup>2</sup>
§15.215(c)	20 dB bandwidth	Pass

Notes: <sup>1</sup> 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

<sup>2</sup> The Antennas are located within the enclosure of EUT and not user accessible.

### 2.2 FCC Part 15 Subpart C, intentional radiatorstest 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

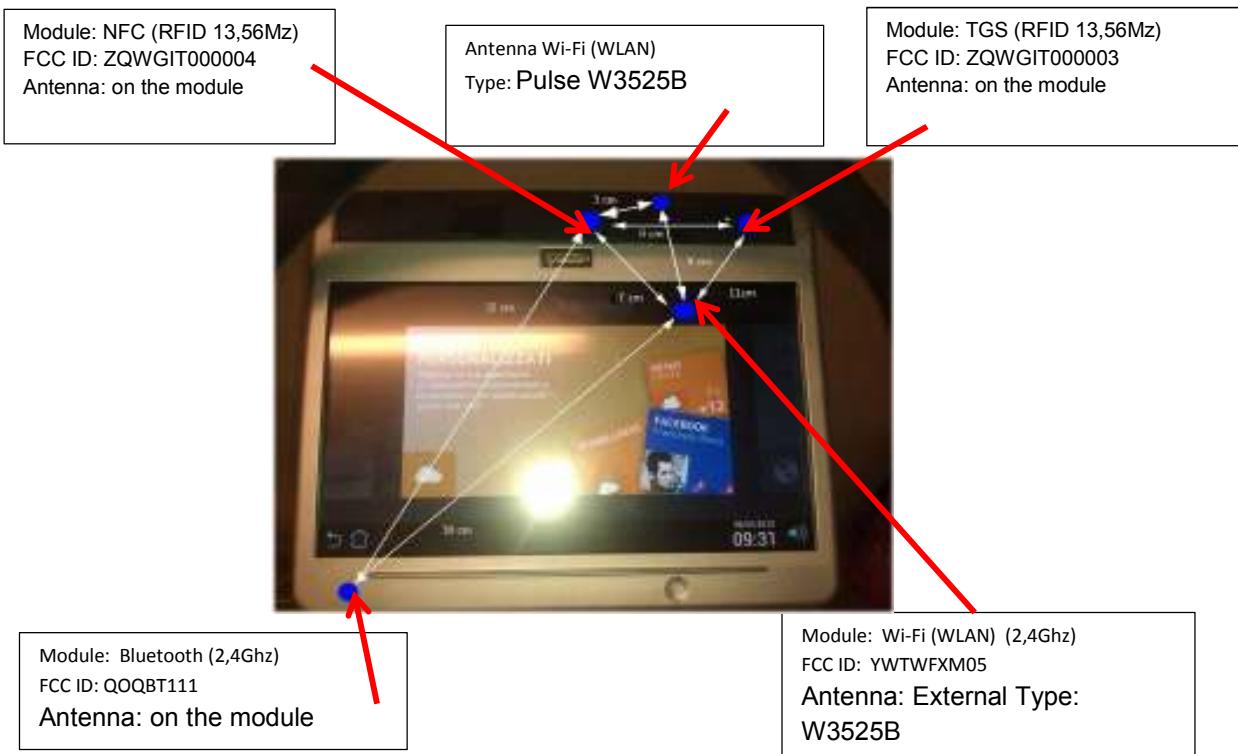
**Product name** NFC RFID  
**Model** NFC 12V Reader  
**Model variant** none  
**Serial number** Not labeled

### 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

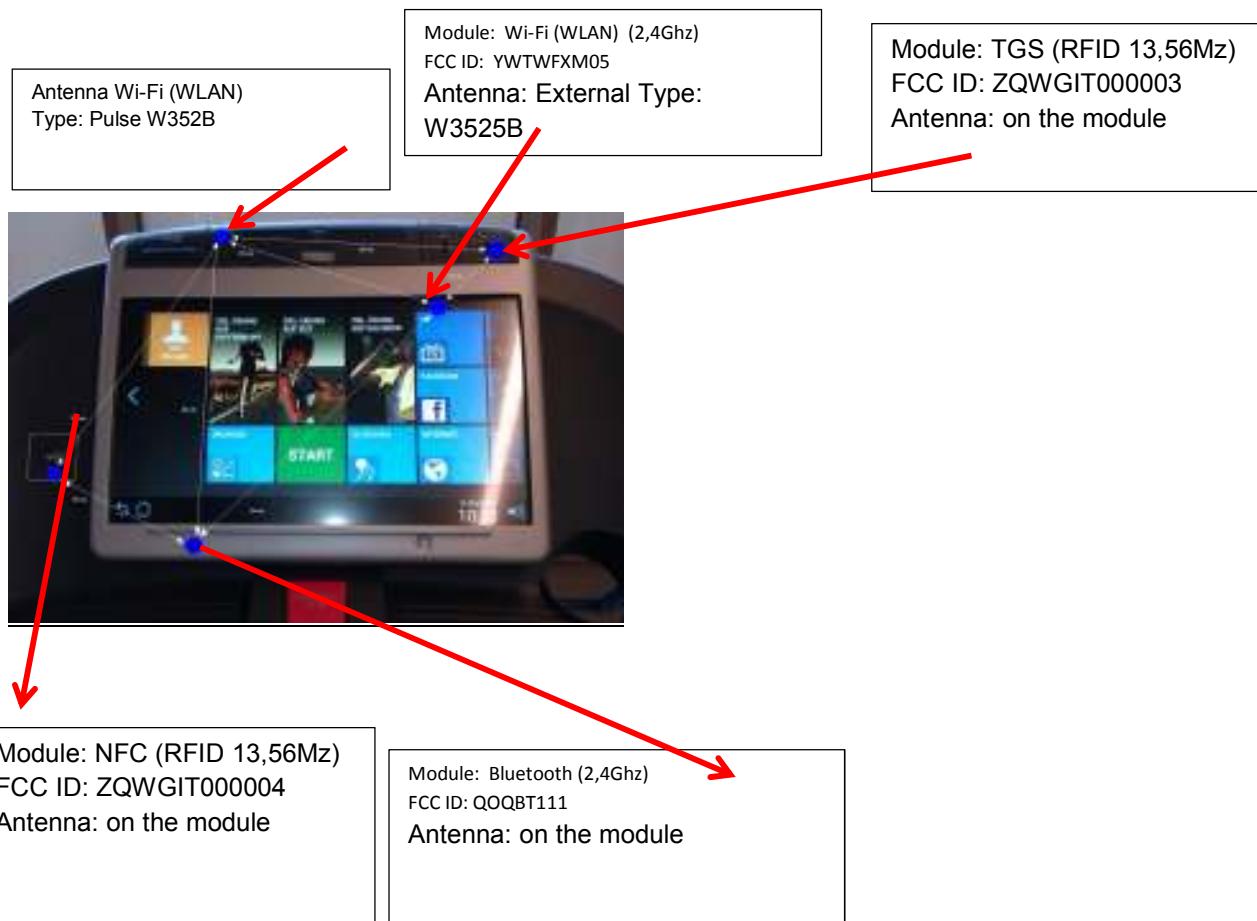
Visio Excite Small for Treadmill:



Operating conditions:Reading the tag continuosly

**Section 3:****Equipment under test (EUT) details**

Visio Excite BIG for Treadmill



Operating conditions:Reading the tag continuosly

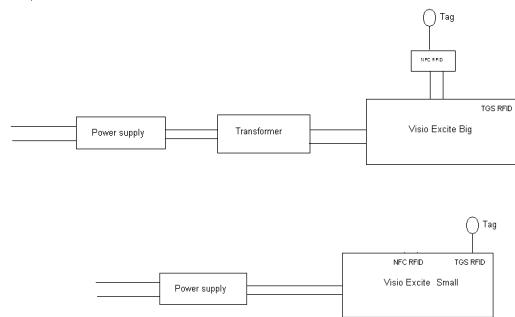
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**3.5 EUT exercise details**

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Equipment 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

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### 4.1 Modifications incorporated in the EUT

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

### 4.2 Technical judgment

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None

### 4.3 Deviations from laboratory tests procedures

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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	860–1060 mbar

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  $\mu$ H/50  $\Omega$  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  $\Omega$ /50  $\mu$ H line impedance stabilization network (LISN).

**Table 8.1-1: Conducted emissions limit**

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

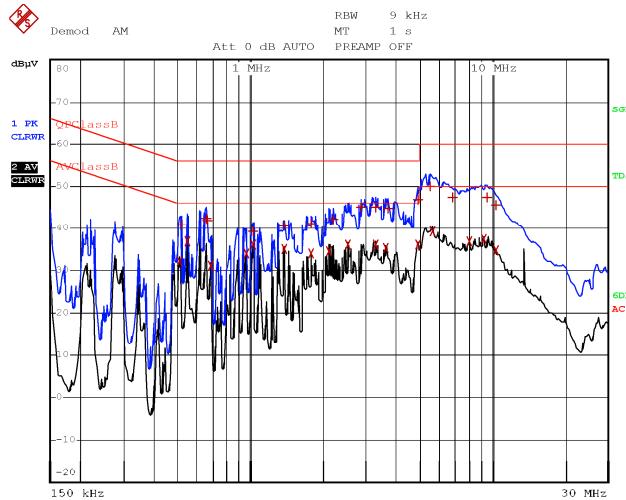
The EUT was set up as tabletop configuration.

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



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

Frequency MHz	Average result dB $\mu$ V	Meas. Time,ms	Bandwidth kHz	Preamp	Correction, dB	Margin, dB	Limit, dB $\mu$ V
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
<b>0.6860</b>	<b>31.2</b>	<b>100</b>	<b>9</b>	<b>off</b>	<b>10.3</b>	<b>-14.8</b>	<b>46.0</b>
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:

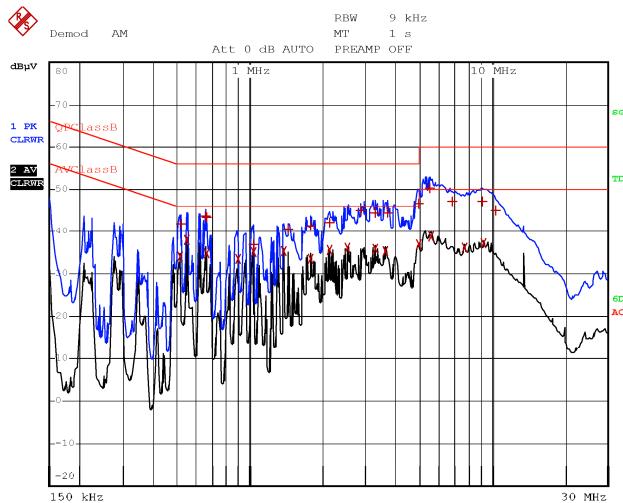
Correction factor (dB) = LISN factor IL (dB) + cable loss (dB) + attenuator (dB)

Result (dB $\mu$ V) = XX dB $\mu$ V (reading from receiver) + XX dB (Correction factor)

Example:

43.5 dB $\mu$ V = 23.2 dB $\mu$ V (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 results on neutral line Small**

Frequency MHz	Q-Peak result dB $\mu$ V	Meas. Time, ms	Bandwidth kHz	Preamp	Correction, dB	Margin, dB	Limit, dB $\mu$ V
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:  $43.5 \text{ dB}\mu\text{V} = 23.2 \text{ dB}\mu\text{V} (\text{receiver reading}) + 10.1 \text{ dB} (\text{LISN factor IL}) + 0.2 \text{ dB} (\text{cable loss}) + 10 \text{ dB} (\text{attenuator})$

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

Frequency MHz	Average result dB $\mu$ V	Meas. Time, ms	Bandwidth kHz	Preamp	Correction, dB	Margin, dB	Limit, dB $\mu$ V
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:

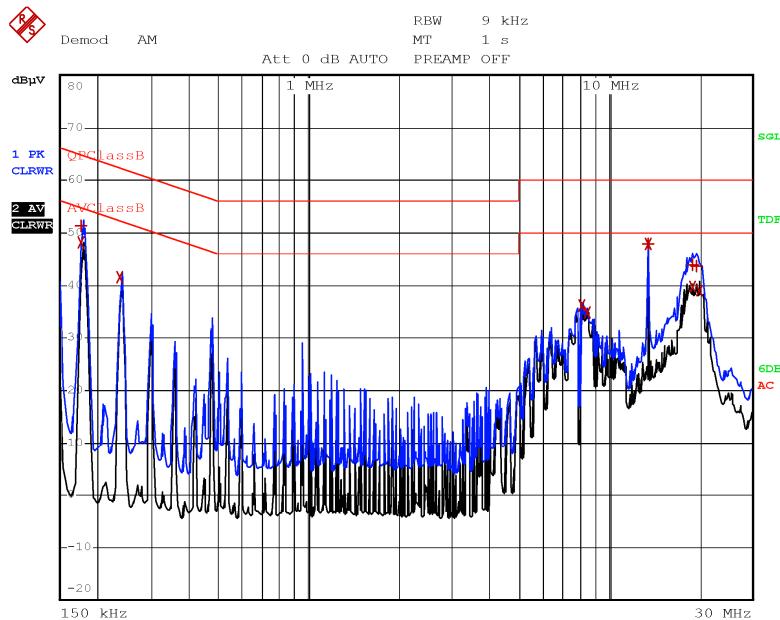
Correction factor (dB) = LISN factor IL (dB) + cable loss (dB) + attenuator (dB)

Result (dB $\mu$ V) = XX dB $\mu$ V (reading from receiver) + XX dB (Correction factor)

Example:

dB $\mu$ V = 23.2 dB $\mu$ V (receiver reading) + 10.1 dB (LISN factor IL) + 0.2 dB (cable loss) + 10 dB (attenuator)

8.1.4 Test data, continue



Date: 17.JUN.2013 15:51:12

**Plot 8.1-3: Conducted emissions on phase line Big**

**Table 8.1-6: Quasi-Peak conducted emissions results on phase line Big**

Frequency MHz	Q-Peak result dBμV	Meas. Time ms	Bandwidth kHz	Preamp	Correction, dB	Margin, dB	Limit, dBμV
0.17800	51.3	100	9	off	11.5	-13.3	64.6
13.56200	47.9	100	9	off	10.7	-12.1	60.0
19.05000	43.9	100	9	off	10.9	-16.1	60.0
19.70600	43.5	100	9	off	10.9	-16.5	60.0

Note:  $43.5 \text{ dB}\mu\text{V} = 23.2 \text{ dB}\mu\text{V} (\text{receiver reading}) + 10.1 \text{ dB} (\text{LISN factor IL}) + 0.2 \text{ dB} (\text{cable loss}) + 10 \text{ dB} (\text{attenuator})$

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

Frequency MHz	Average result dB $\mu$ V	Meas. Time ms	Bandwidth kHz	Preamp	Correction, dB	Margin, dB	Limit, dB $\mu$ V
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:

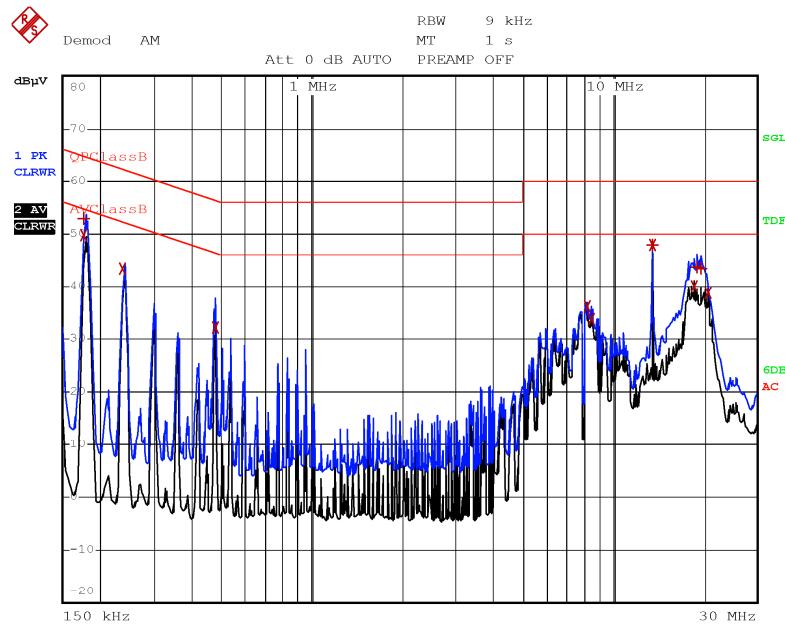
Correction factor (dB) = LISN factor IL (dB) + cable loss (dB) + attenuator (dB)

Result (dB $\mu$ V) = XX dB $\mu$ V (reading from receiver) + XX dB (Correction factor)

Example:

dB $\mu$ V = 23.2 dB $\mu$ V (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 B**

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

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:

$\text{dBμV} = 23.2 \text{ dBμV} (\text{receiver reading}) + 10.1 \text{ dB} (\text{LISN factor IL}) + 0.2 \text{ dB} (\text{cable loss}) + 10 \text{ dB} (\text{attenuator})$

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

Frequency MHz	Average result dB $\mu$ V	Meas. Time ms	Bandwidth kHz	Preamp	Correction, dB	Margin, dB	Limit, dB $\mu$ V
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 (dB $\mu$ V) = XX dB $\mu$ V (reading from receiver) + XX dB (Correction factor)

Example:

43.5 dB $\mu$ V = 23.2 dB $\mu$ V (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	<b>13.342</b>	13.110	<b>0.232</b>
13.560	<b>13.342</b>	13.110	<b>0.232</b>

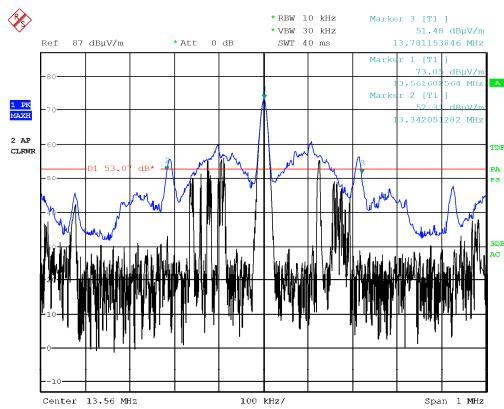
**Table 8.2-2: Upper 20 dBc frequency cross result**

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

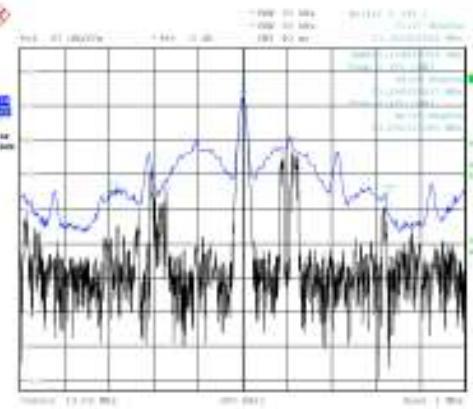
**Table 8.2-3: 99 % occupied bandwidth result**

Frequency, MHz	99 % occupied bandwidth, MHz
13.56	<b>0.622</b>
13.56	<b>0.572</b>

### 8.2.4 Test data, continued



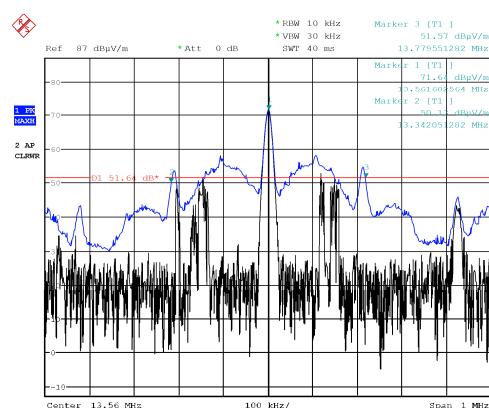
Date: 27.MAY.2013 15:55:37



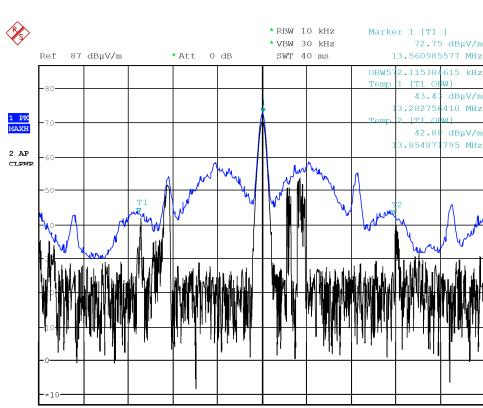
Date: 27.MAY.2013 15:54:04

**Figure 8.2-1: 20 dB bandwidth spectrum plot (Small configuration)**

**Figure 8.2-2: 99 % occupied bandwidth spectrum plot (Small Configuration)**



Date: 27.MAY.2013 20:30:02



Date: 27.MAY.2013 20:28:09

**Figure 8.2-33: 20 dB bandwidth spectrum plot (Big Configuration)**

**Figure 8.2-44: 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  $\mu$ V/m (84 dB $\mu$ 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  $\mu$ V/m(50.5dB $\mu$ 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  $\mu$ V/m(40.5dB $\mu$ V/m)at 30 m.

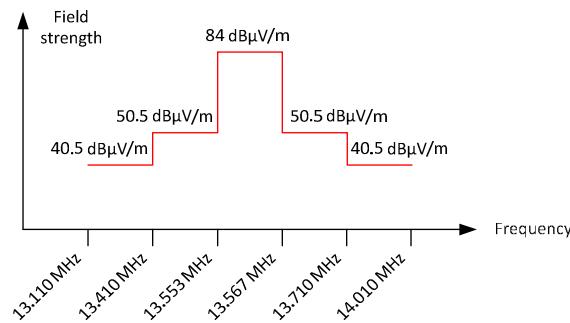


Figure 8.3-1: In-band spurious emissions limit

### 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):  

$$40 \times \log_{10} (3 \text{ m}/30 \text{ m}) = 40 \times \log_{10} (0.1) = -40 \text{ dB}$$

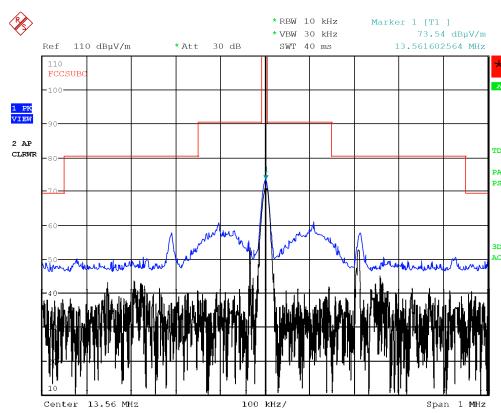
### 8.3.4 Test data

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

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

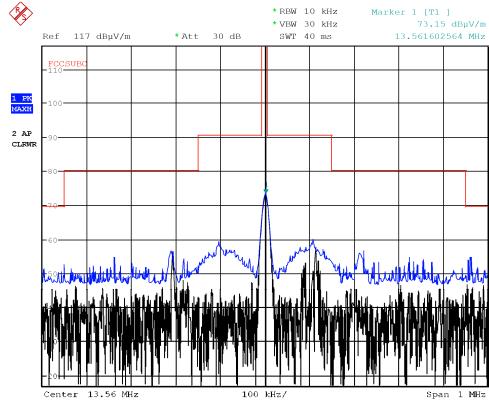
Note: Calculated field strength at 30 m = Measured field strength at 3 m – 40 dB

### 8.3.4 Test data, continued



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

**Figure 8.3-2: Field strength measurement spectrum plot within 13.110–14.01 MHz band Small**



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

**Figure 8.3-3: Field strength measurement spectrum plot within 13.110–14.01 band 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
	µV/m	dBµV/m	
0.009–0.490	2400/F	67.6 – 20 × log <sub>10</sub> (F)	300
0.490–1.705	24000/F	87.6 – 20×log <sub>10</sub> (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.



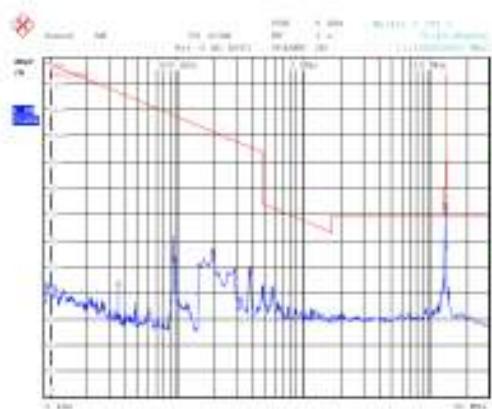
#### 8.4.4 Test data

##### 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.

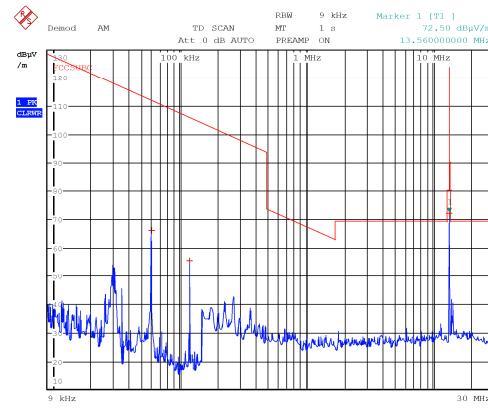
**Duty cycle/average factor calculation:** DC-CF =  $20 \times \log_{10} (T_{100\text{ms}} \div 100 \text{ ms})$

Small Configuration



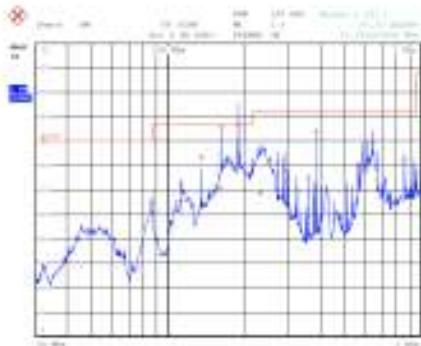
Software: 21.000.2.0.0 (Rev.12.01)

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



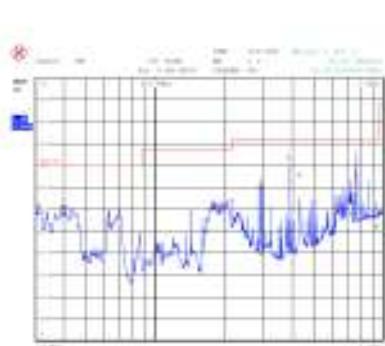
Date: 27.MAY.2013 20:34:12

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



Software: 21.000.2.0.0 (Rev.12.01)

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



Software: 21.000.2.0.0 (Rev.12.01)

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



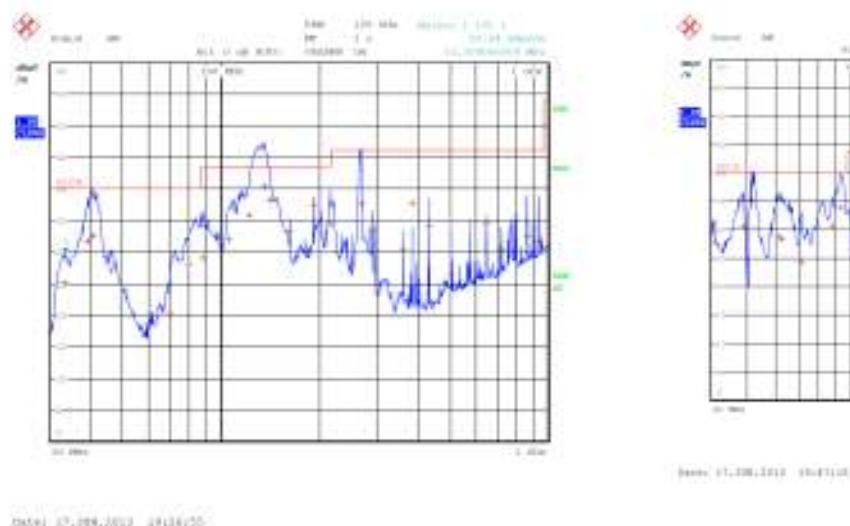
#### 8.4.4 Test data, continue

##### Duty cycle/average factor calculations

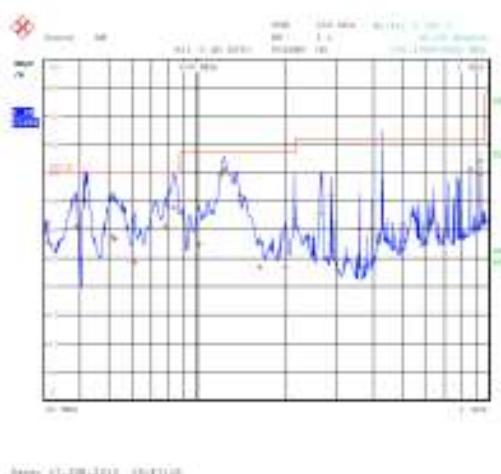
§15.35(c) When the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed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

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

Big Configuration



**Figure 8.4-5:** Field strength of spurious emissions within 30 1000 MHz band  
Big, horizontal polarization



**Figure 8.4-6:** Field strength of spurious emissions within 30 1000 MHz band  
Big, vertical polarization

**Table 8.4-3: Radiated emission Small**

Frequency MHz	Q-Peak result dB $\mu$ V/m	Meas. Time ms	Bandwidth, Hz	Preamp	Correction, dB	Margin, dB	Limit, dB $\mu$ V/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 (dB $\mu$ V/m) = XX dB $\mu$ V (reading from receiver) + XX dB (Correction factor)

Example:

43.5 dB $\mu$ V = 23.2 dB $\mu$ V (receiver reading) + correction factor

**Table 8.4-4: Radiated emission Big**

Frequency MHz	Q-Peak result dB $\mu$ V/m	Meas. Time ms	Bandwidth kHz	Preamp	Correction, dB	Margin, dB	Limit, dB $\mu$ V/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 (dB $\mu$ V/m) = XX dB $\mu$ V (reading from receiver) + XX dB (Correction factor)

Example:

43.5 dB $\mu$ V = 23.2 dB $\mu$ V (receiver reading) + correction factor



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

Frequency MHz	Q-Peak result dB $\mu$ V/m	Meas. Time ms	Bandwidth kHz	Preamp	Correction, dB	Margin, dB	Limit, dB $\mu$ V/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 (dB $\mu$ V/m) = XX dB $\mu$ V (reading from receiver) + XX dB (Correction factor)

Example:

43.5 dB $\mu$ V = 23.2 dB $\mu$ V (receiver reading) + correction factor



**Table 8.4-6: Radiated emission Big 30 MHz 1000 MHz horizontal**

Frequency MHz	Q-Peak result dB $\mu$ V/m	Meas. Time ms	Bandwidth kHz	Preamp	Correction, dB	Margin, dB	Limit, dB $\mu$ V/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 (dB $\mu$ V/m) = XX dB $\mu$ V (reading from receiver) + XX dB (Correction factor)

Example:

43.5 dB $\mu$ V = 23.2 dB $\mu$ V (receiver reading) + correction factor

**Table 8.4-7: Radiated emission Small 30 1000 v**

Frequency MHz	Qp result dB $\mu$ V/m	Meas. Time ms	Bandwidth kHz	Filter	Correction, dB	Margin, dB	Limit, dB $\mu$ V/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 (dB $\mu$ V/m) = XX dB $\mu$ V (reading from receiver) + XX dB (Correction factor)

Example:

43.5 dB $\mu$ V = 23.2 dB $\mu$ V (receiver reading) + factor

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

Frequency MHz	QP result dB $\mu$ V/m	Meas. Time ms	Bandwidth kHz	Filter	Correction, dB	Margin, dB	Limit, dB $\mu$ V/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 (dB $\mu$ V/m) = XX dB $\mu$ V (reading from receiver) + XX dB (Correction factor)

Example:

43.5 dB $\mu$ V = 23.2 dB $\mu$ V (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*

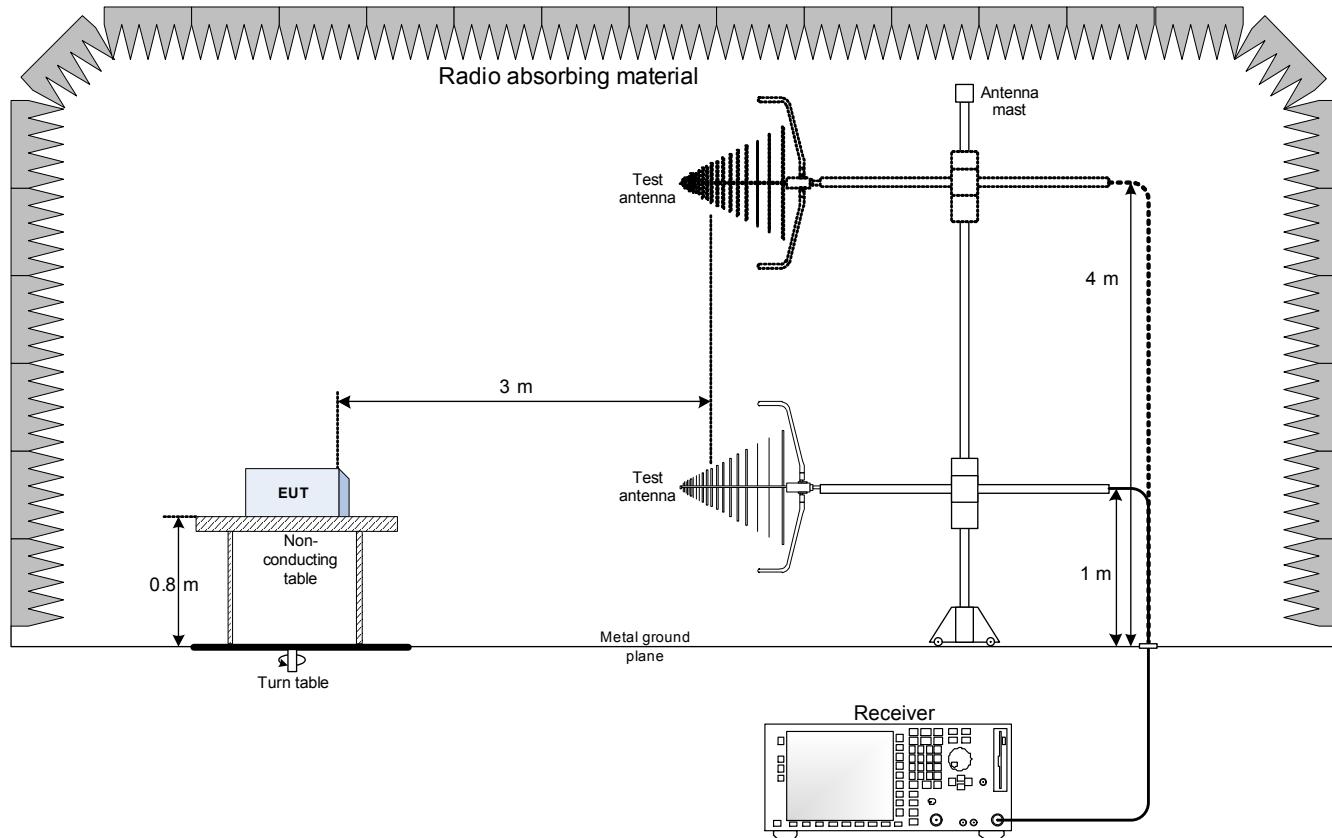
Test conditions	Frequency, MHz	Frequency drift, MHz	Frequency drift, %	Limit, ±%	Margin, %
+50 °C, Nominal	13.56126754	0.00020041	0.001477834	0.01	0.0085222
+40 °C, Nominal	13.56121743	0.00015030	0.00110832	0.01	0.0088917
+30 °C, Nominal	13.56121743	0.00015030	0.00110832	0.01	0.0088917
+20 °C, +15 %	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, ±%	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

