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Compliance test report ID **236204TRFWL**

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	TGS RFID
Model	Mifare 3V3 Reader
Model variant	none
FCC ID	ZQWGIT000003

Test location

Nemko Spa a Socio Unico
Via del Carroccio, 4 20853 Biassono (MB) Italy
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FCC test site registration number: 481407 (10 m Semi anechoic chamber)

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Toll free --
Website www.Nemko.com/it

Tested by Daniele Guarnone

Reviewed by Gabriele Curioni May 30, 2013

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.

Copyright notification

Table of contents

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 foundcompliant.

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 radiators 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	236204TRFWL

3.2 EUT information

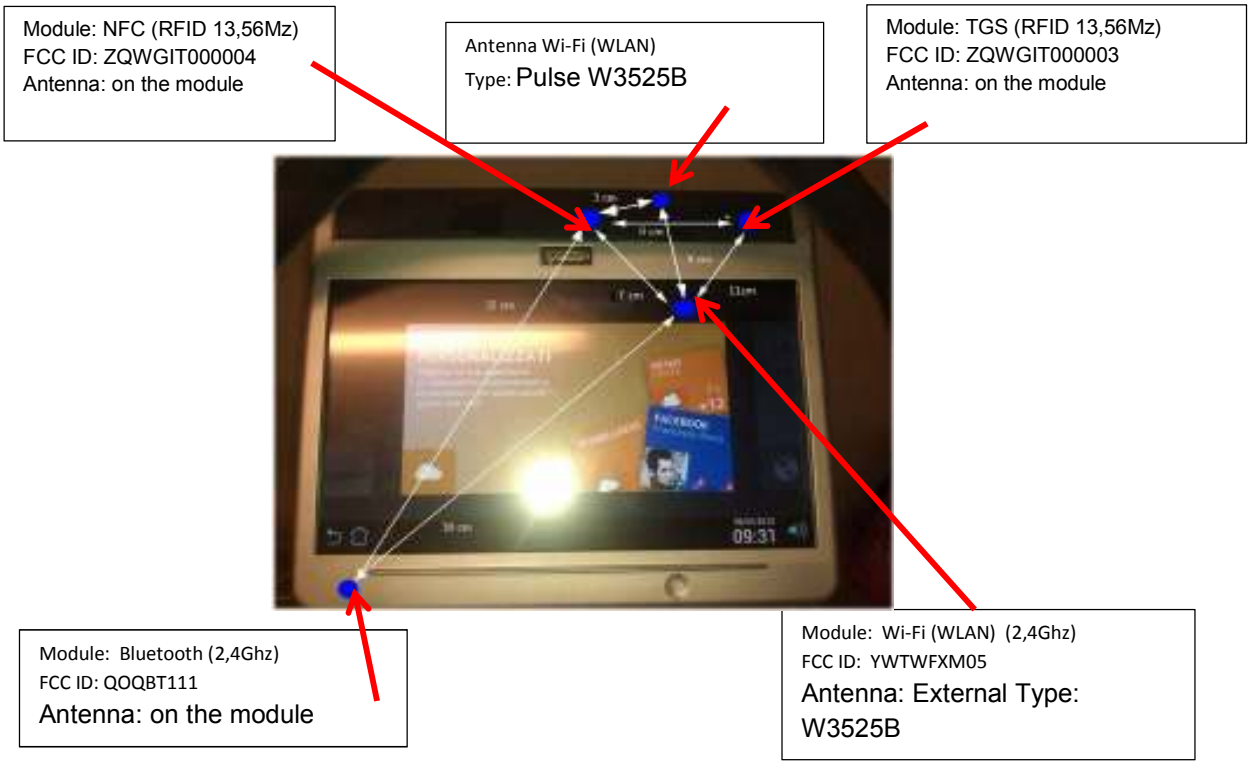
Product name	TGS RFID
Model	Mifare 3V3 Reader
Model variant	none
Serial number	Not labeled

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

Antenna Wi-Fi (WLAN)
Type: Pulse W352B

Module: Wi-Fi (WLAN) (2,4Ghz)
FCC ID: YWTWFXM05
Antenna: External Type: W3525B

Module: TGS (RFID 13,56Mz)
FCC ID: ZQWGIT000003
Antenna: on the module

Module: NFC (RFID 13,56Mz)
FCC ID: ZQWGIT000004
Antenna: on the module

Module: Bluetooth (2,4Ghz)
FCC ID: QOQBT111
Antenna: on the module

Operating conditions:Reading the tag continuosly

3.5 EUT exercise details

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

3.6 EUT setup diagram

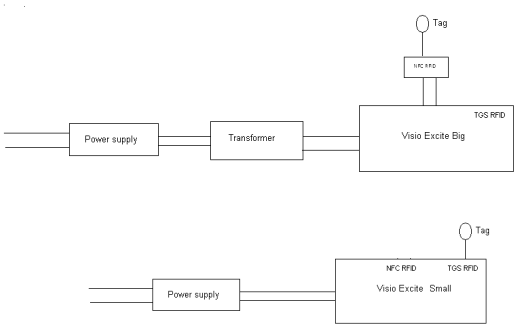


Figure3.6-1: *Setup diagram*

3.7 EUT sub assemblies

Table 3.7-1: *EUT sub assemblies*

Description	Brand name	Model/Part number	Serial number
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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 ±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

8.1.4 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 µH/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 µH line impedance stabilization network (LISN).

Table 8.1-1: *Conducted emissions limit*

Frequency of emission (MHz)	Conducted limit (dBµV)	
	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.

8.1.5 Test summary

Test date	May 28, 2013	**Test engineer**	Daniele Guarnone	**Verdict**	Pass
Temperature	24 °C	**Air pressure**	990 mbar	**Relative humidity**	50 %

8.1.6 Observations/special notes

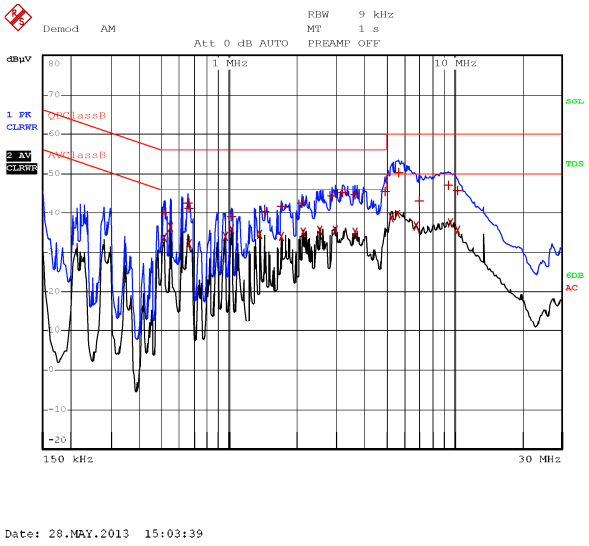
The EUT was set up as tabletop configuration.

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

8.1.7 Test data



Plot 8.1-1: *Conducted emissions on phase line Small Configuration*

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

Frequency, MHz	Q-Peak result dBµV	Meas. Time ms	Bandwidt kHz	Preamp	Correction, dB	Margin, dB	Limit, dBµV
0.658	42.5	100	9	off	10.3	-13.5	56
0.666	41.4	100	9	off	10.3	-14.6	56
1.03	38.9	100	9	off	10.3	-17.1	56
1.45	40.2	100	9	off	10.3	-15.8	56
1.71	41.9	100	9	off	10.3	-14.1	56
2.126	42.6	100	9	off	10.3	-13.4	56
2.882	44.5	100	9	off	10.4	-11.5	56
3.218	45.1	100	9	off	10.4	-10.9	56
3.634	44.6	100	9	off	10.4	-11.4	56
4.974	45.5	100	9	off	10.4	-10.5	56
5.654	50.1	100	9	off	10.5	-9.9	60
7.01	43	100	9	off	10.5	-17	60
9.494	47.1	100	9	off	10.6	-12.9	60
10.406	45.8	100	9	off	10.6	-14.2	60

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)

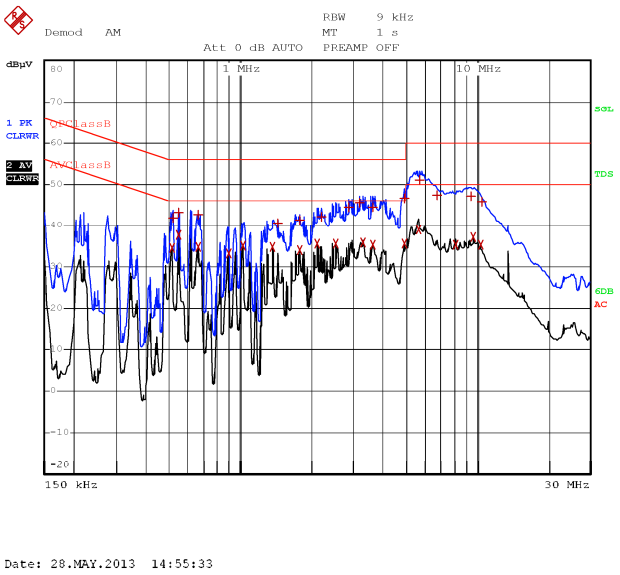
Results on phase line Small Configuration

Frequency MHz	Average result dBµV	Meas. Time ms	Bandwidth kHz	Peamp	Correction, dB	Margin, dB	Limit, dBµV
0.514	33.6	100	9	off	10.4	-12.4	46
0.55	36.4	100	9	off	10.4	-9.6	46
0.666	32.1	100	9	off	10.3	-13.9	46
0.962	34.1	100	9	off	10.3	-11.9	46
1.03	35.8	100	9	off	10.3	-10.2	46
1.374	34.5	100	9	off	10.3	-11.5	46
1.718	34	100	9	off	10.3	-12	46
2.13	35	100	9	off	10.3	-11	46
2.546	35.6	100	9	off	10.4	-10.4	46
2.966	35.5	100	9	off	10.4	-10.5	46
3.642	35.1	100	9	off	10.4	-10.9	46
5.282	38.7	100	9	off	10.4	-11.3	50
5.642	39.8	100	9	off	10.5	-10.2	50
6.83	36.6	100	9	off	10.5	-13.4	50
9.654	37.3	100	9	off	10.6	-12.7	50
10.422	35.4	100	9	off	10.6	-14.6	50

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 Configuration*

Table 8.1-3: *Quasi-Peak conducted emissions results on neutral line Small Configuration*

Frequency MHz	Q-Peak result dBµV	Meas. Time ms	Bandwidth kHz	Preamp	Correction, dB	Margin, dB	Limit, dBµV
0.518	41.7	100	9	off	10.4	-14.3	56
0.546	43.1	100	9	off	10.4	-12.9	56
0.662	42.7	100	9	off	10.3	-13.3	56
1.45	40.5	100	9	off	10.3	-15.5	56
1.794	41.2	100	9	off	10.3	-14.8	56
2.206	42	100	9	off	10.3	-14	56
2.878	44.5	100	9	off	10.4	-11.5	56
3.214	45.4	100	9	off	10.4	-10.6	56
3.638	44.4	100	9	off	10.4	-11.6	56
4.97	46.6	100	9	off	10.4	-9.4	56
5.73	51.1	100	9	off	10.5	-8.9	60
6.826	47.3	100	9	off	10.5	-12.7	60
9.486	47.2	100	9	off	10.6	-12.8	60
10.422	45.7	100	9	off	10.6	-14.3	60

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)

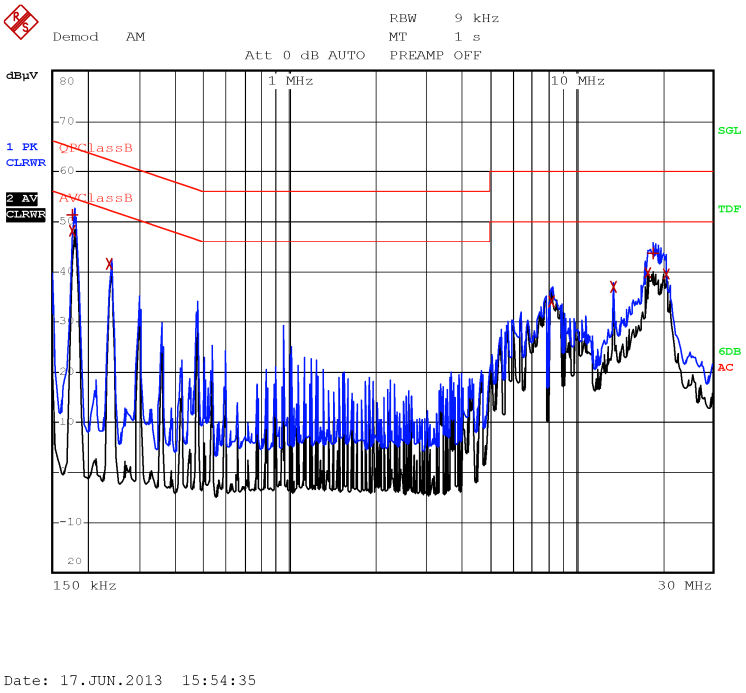
Table 8.1-4: *Average conducted emissions results on neutral line Small Configuration*

Frequency MHz	Average result dBµV	Meas. Time ms	Bandwidth kHz	Preamp	Correction, dB	Margin, dB	Limit, dBµV
0.514	33.6	100	9	off	10.4	-12.4	46
0.55	36.4	100	9	off	10.4	-9.6	46
0.666	32.1	100	9	off	10.3	-13.9	46
0.962	34.1	100	9	off	10.3	-11.9	46
1.03	35.8	100	9	off	10.3	-10.2	46
1.374	34.5	100	9	off	10.3	-11.5	46
1.718	34	100	9	off	10.3	-12	46
2.13	35	100	9	off	10.3	-11	46
2.546	35.6	100	9	off	10.4	-10.4	46
2.966	35.5	100	9	off	10.4	-10.5	46
3.642	35.1	100	9	off	10.4	-10.9	46
5.282	38.7	100	9	off	10.4	-11.3	50
5.642	39.8	100	9	off	10.5	-10.2	50
6.83	36.6	100	9	off	10.5	-13.4	50
9.654	37.3	100	9	off	10.6	-12.7	50
10.422	35.4	100	9	off	10.6	-14.6	50

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)

8.1.4 Test data, continued



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

Table 8.1-5: *Quasi-Peak conducted emissions results on phase line Big Configuration*

Frequency MHz	Q-Peak result dBµV	Meas. Time ms	Bandwidth kHz	Preamp	Correction, dB	Margin, dB	Limit, dBµV
0.17800	51.2	100	9	off	11.5	-13.3	64.6
18.63400	43.6	100	9	off	10.9	-16.4	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)

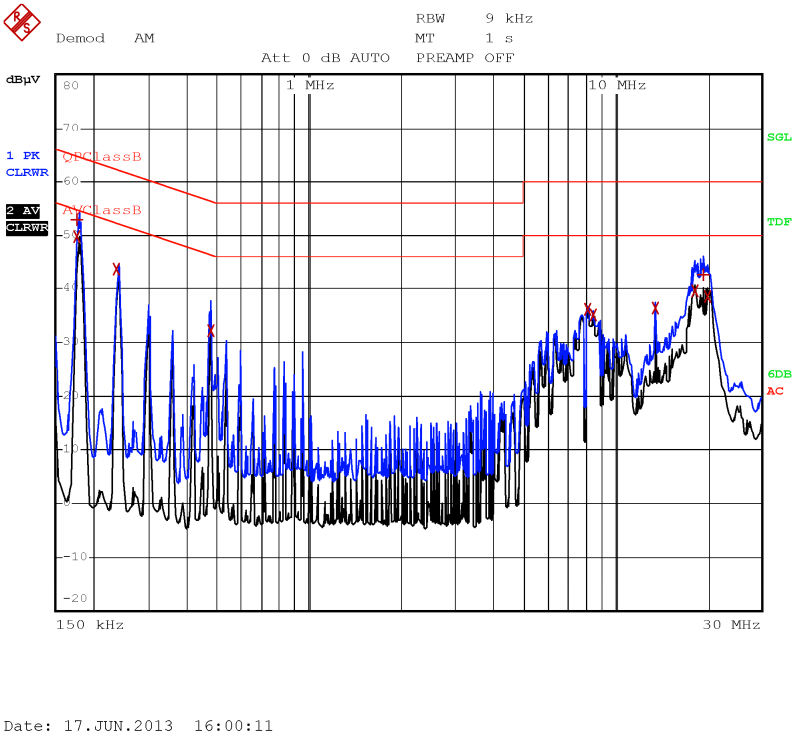
Table 8.1-6: *Average conducted emissions results on phase line Big Configuration*

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
8.27400	34.0	100	9	off	10.5	-16.0	50.0
13.56200	36.7	100	9	off	10.7	-13.3	50.0
17.91800	39.7	100	9	off	10.9	-10.3	50.0
20.59800	39.5	100	9	off	11.0	-10.5	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)

8.1.4 Test data, continued



Plot 8.1-4: *Conducted emissions on neutral line Big Configuration*

Table 8.1-7: *Quasi-Peak conducted emissions results on neutral line Big Configuration*

Frequency MHz	Q-Peak result dBµV	Meas. Time ms	Bandwidth kHz	Preamp	Correction, dB	Margin, dB	Limit, dBµV
0.17800	52.9	100	9	off	11.5	-11.6	64.6
19.52600	52.0	100	9	off	10.9	-17.4	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 8.1-8: *Average conducted emissions results on neutral line Big Configuration*

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	-8.6	52.2
0.47800	32.1	100	9	off	10.4	-14.3	46.4
8.15400	36.1	100	9	off	10.5	-13.9	50.0
8.51400	35.1	100	9	off	10.5	-14.9	50.0
13.56200	36.4	100	9	off	10.7	-13.6	50.0
18.27400	39.4	100	9	off	10.9	-10.6	50.0
20.06200	38.3	100	9	off	11.0	-11.7	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)

8.2 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 Gaurnone	**Verdict**	Pass
Temperature	24 °C	**Air pressure**	991 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 8.2.4 Test data

Table 8.2-1: *Lower20dBcfrequency crossresult*

Fundamental frequency, MHz	Lower 20 dBc frequency cross, MHz	Limit, MHz	Margin, MHz
13.560 (Small Configuration)	**13.343**	13.110	**0.233**
13.560 (Big Configuratio)	**13.344**	13.110	**0.234**

Table 8.2-2: *Upper 20 dBcfrequencycrossresult*

Fundamental frequency, MHz	Upper 20 dBc frequency cross, MHz	Limit, MHz	Margin, MHz
13.560 (Small Configuration)	**13.781**	14.010	**0.229**
13.560 (Big Configuratio)	**13.780**	14.010	**0.230**

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

Frequency, MHz	99 % occupied bandwidth, MHz
13.56 (Small configuration)	**0.923**
13.56 (Big Configuration)	**0.953**

8.2.4 Test data, continued

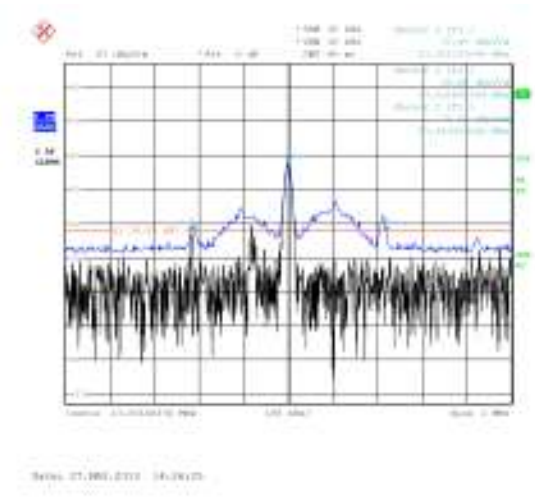


Figure8.2-1: *20dBbandwidth spectrum plot (Small)*

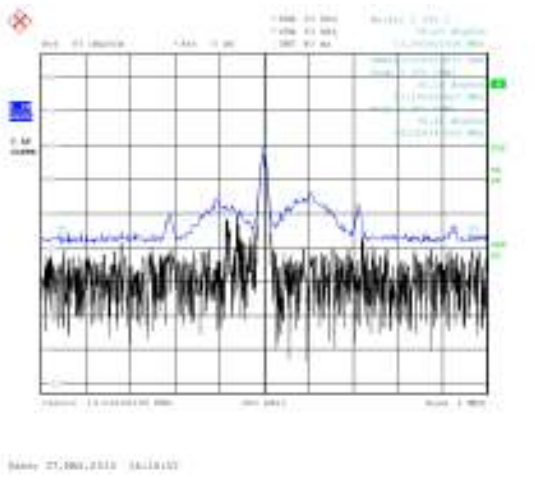


Figure8.2-2: *99 % occupied bandwidth spectrum plot (Small)*

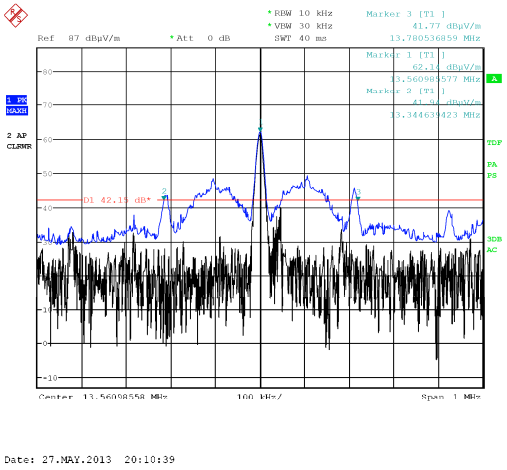


Figure8.2-3: *20 dBbandwidth spectrum plot (Big)*

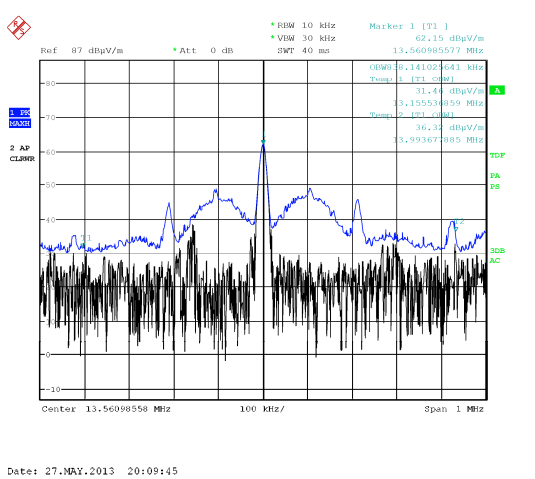


Figure8.2-4: *99 % occupied bandwidth spectrum plot (Big)*

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 µV/m (84 dBµV/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 µV/m(50.5dBµV/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 µV/m(40.5dBµV/m)at 30 m.

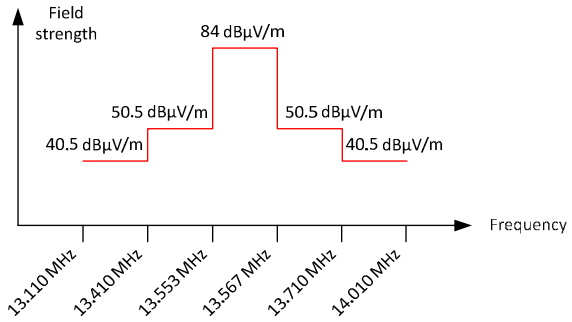


Figure8.3-1: *In-band spurious emissions limit*

8.3.2 Test summary

Test date	May 27, 2013	**Test engineer**	Select a name	**Verdict**	Pass
Temperature	Choose temperature °C	**Air pressure**	Select air pressure mbar	**Relative humidity**	Select humidity %

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):

$$40 \times \mathrm{Log}_{10}\,(3\ \mathrm{m}/30\ \mathrm{m}) = 40 \times \mathrm{Log}_{10}\,(0.1) = -40\ \mathrm{dB}$$

8.3.4 Test data

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

Frequency, MHz	Field strength at 3 m, dBµV/m	Calculated field strength at 30 m, dBµV/m	Limit, dBµV/m	Margin, dB
13.56 (Small)	58.4	18.4	84	65.6
13.56 (Big)	53.9	13.9	84	71.1

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

8.3.4 Test data, continued

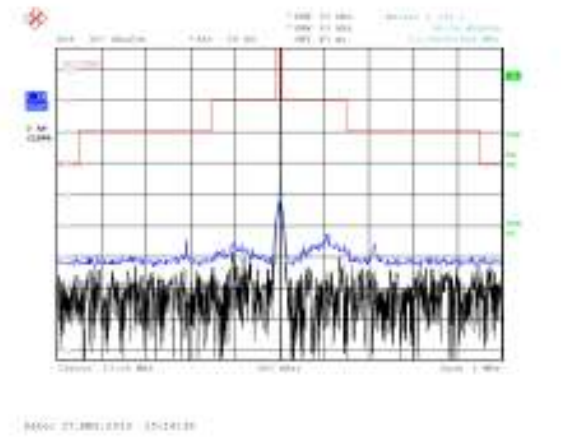


Figure8.3-2: *Field strength measurement spectrum plot within* ***13.110–14.0100 MHz*** *band(Small Configuration)*

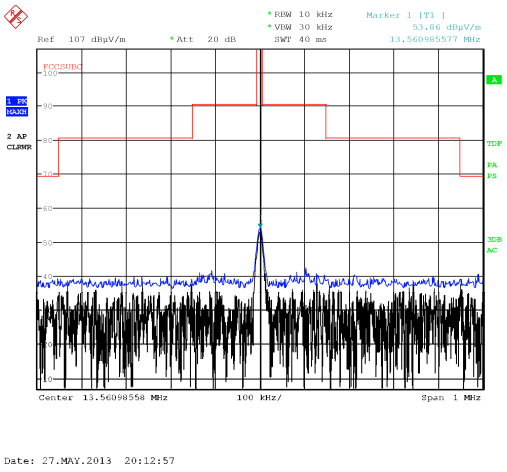


Figure8.3-3: *Field strength measurement spectrum plot within* ***13.110–14.010****band (Big Configuration)*

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	$67.6 – 20 \times \log_{10}(F)$	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 to1 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 × $\log_{10}$ ($Tx_{100\ ms}$ ÷ 100 ms)

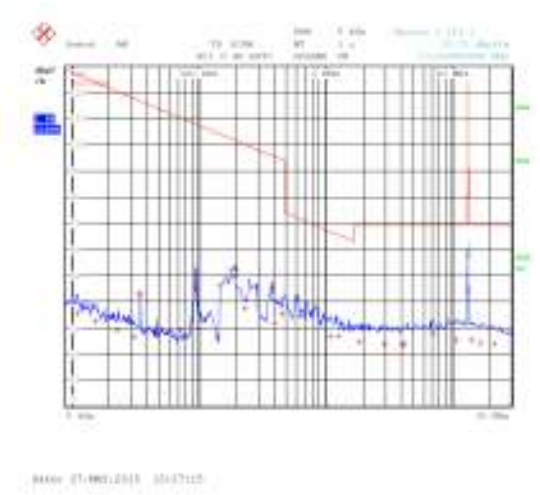


Figure8.4-1: *Field strength of spurious emissions within 9kHz 30 MHzband*

Small Configuration

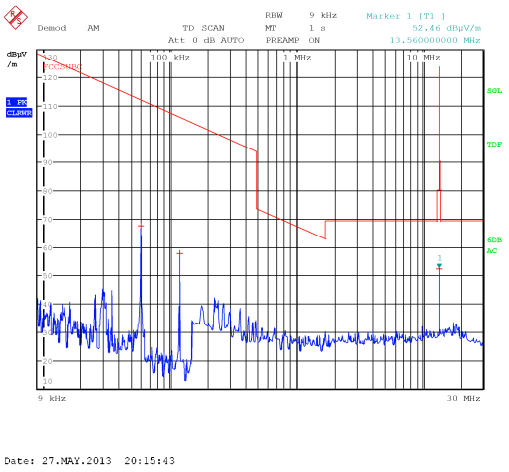


Figure8.4-2: *Field strength of spurious emissions within 9kHz 30 MHz band*

Big Configuration

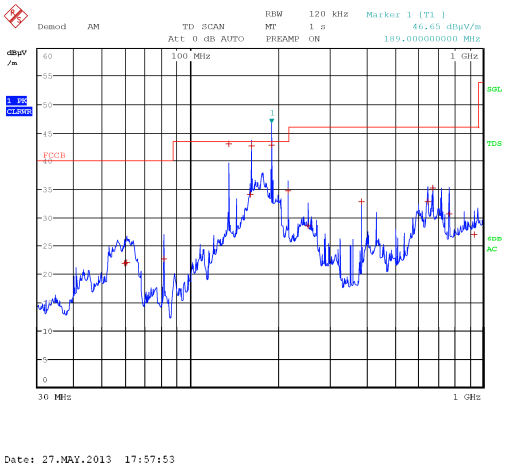


Figure8.4-3: *Field strength of spurious emissions within 30- 1000MHz band*

Horizontal polarization Small Configuration

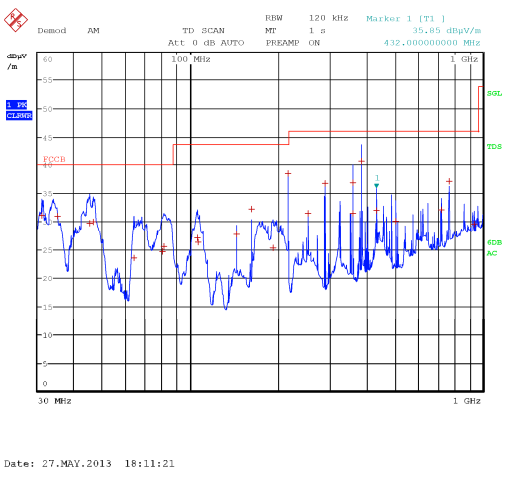


Figure8.4-4: *Field strength of spurious emissions within 30-1000MHz band*

Vertical polarization Small Configuration

8.4.4 Test data, continue

Big Configuration

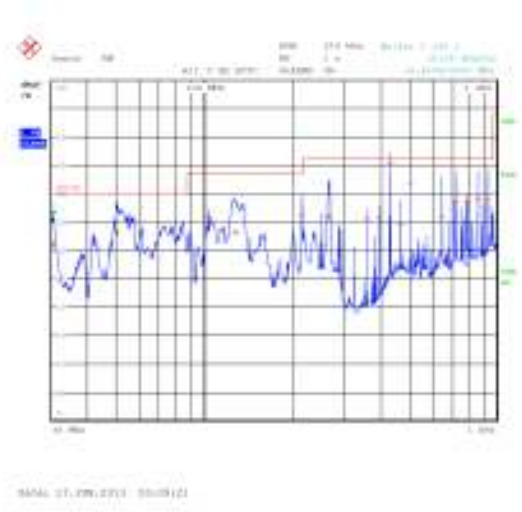


Figure8.4-5: *Field strength of spurious emissions within 30 1000 MHz band Big, vertical polarization*

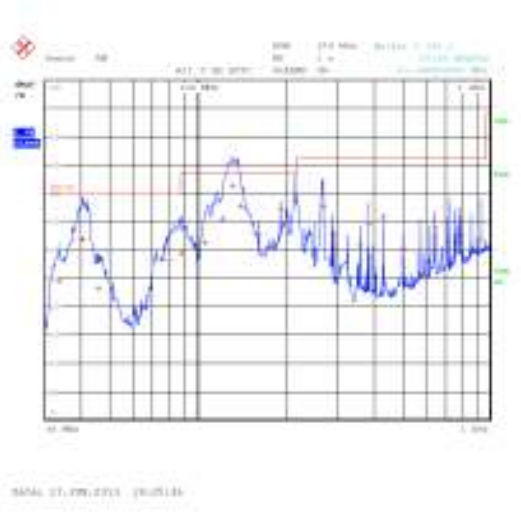


Figure8.4-6: *Field strength of spurious emissions within 30 1000 MHz band Big, horizontal polarization*

Table 8.4-3: *Radiated emission Small*

Frequency MHz	QP result dBµV/m	Meas. Time ms	Bandwidth kHz	preamp	Correction, dB	Margin, dB	Limit, dBµV/m
0.01110	35.5	100	0.2	on	20.0	-91.2	126.7
0.01565	32.7	100	0.2	on	20.0	-91.0	123.7
0.02285	29.0	100	0.2	on	20.0	-91.4	120.4
0.03125	26.2	100	0.2	on	20.0	-91.4	117.7
0.03470	43.1	100	0.2	on	20.0	-73.7	116.8
0.03475	42.4	100	0.2	on	20.0	-74.4	116.8
0.04685	27.0	100	0.2	on	20.0	-87.2	114.2
0.07335	29.1	100	0.2	on	20.1	-81.2	110.3
0.09650	44.9	100	0.2	on	20.1	-63.0	107.9
0.10270	30.0	100	0.2	on	20.1	-77.3	107.4
0.15000	46.3	100	9	on	20.1	-57.7	104.1
0.18750	49.5	100	9	on	20.1	-52.6	102.1
0.19500	52.4	100	9	on	20.1	-49.4	101.8
0.23250	37.4	100	9	on	20.1	-62.9	100.3
0.38250	45.5	100	9	on	20.1	-50.4	96.0
0.39750	31.3	100	9	on	20.1	-64.3	95.6
0.46500	35.1	100	9	on	20.1	-59.1	94.3
0.63000	34.7	100	9	on	20.1	-36.9	71.6
1.10750	26.3	100	9	on	20.2	-40.4	66.7
1.27000	27.0	100	9	on	20.2	-38.6	65.6
1.88250	24.4	100	9	on	20.2	-45.1	69.5
2.97000	23.7	100	9	on	20.3	-45.8	69.5
4.10750	23.7	100	9	on	20.3	-45.8	69.5
4.30000	23.7	100	9	on	20.4	-45.8	69.5
7.15000	28.0	100	9	on	20.5	-41.5	69.5
10.85500	25.1	100	9	on	20.6	-44.4	69.5
13.56000	56.9	100	9	on	20.6	-67.1	124.0
14.47250	25.2	100	9	on	20.6	-44.3	69.5
17.13250	24.1	100	9	on	20.7	-45.4	69.5
21.99250	23.6	100	9	on	20.8	-45.9	69.5

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

Table 8.4-4: *Radiated emission Big*

Frequency MHz	QP Result dBµV/m	Meas. Time ms	Bandwidth kHz	Preamp	Correction, dB	Margin, dB	Limit, dBµV/m
0.03470	43.2	100	0.2	on	20.0	-73.6	116.8
0.09535	52.7	100	0.2	on	20.1	-55.3	108.0
0.19250	55.9	100	9	on	20.1	-46.0	101.9

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

Table 8.4-5: *Radiated emission Small 30 1000 v*

Frequency MHz	Qp result dBµV/m	Meas. Time ms	Bandwidth kHz	Preamp	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

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

Frequency MHz	QP result dBµV/m	Meas. Time ms	Bandwidth kHz	Preamp	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

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

Frequency MHz	QP result dBµV/m	Meas. Time ms	Bandwidth kHz	Preamp	Correction, dB	Margin, dB	Limit, dBµV/m
30.42500	31.0	15	120	on	11.6	-9.0	40.0
50.32500	32.9	15	120	on	14.5	-7.1	40.0
102.50000	35.7	15	120	on	12.4	-7.8	43.5
127.67500	33.1	15	120	on	9.2	-10.4	43.5
216.00000	36.4	15	120	on	11.3	-9.6	46.0
251.95000	30.7	15	120	on	12.4	-15.4	46.0
267.70000	35.9	15	120	on	12.6	-10.2	46.0
360.00000	35.6	15	120	on	14.4	-10.4	46.0
396.00000	35.9	15	120	on	14.9	-10.1	46.0
431.97500	45.2	15	120	on	15.3	-0.8	46.0
468.02500	34.6	15	120	on	15.9	-11.5	46.0
504.00000	42.0	15	120	on	16.4	-4.1	46.0
647.97500	35.8	15	120	on	18.4	-10.3	46.0
720.05000	38.5	15	120	on	19.5	-7.5	46.0
792.00000	38.5	15	120	on	20.3	-7.5	46.0
864.02500	39.0	15	120	on	21.2	-7.1	46.0
936.25000	38.8	15	120	on	21.6	-7.2	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

Table 8.4-8: *Radiated emission Big 30 1000 horizontal*

Frequency MHz	QP result dBµV/m	Meas. Time, ms	Bandwidth kHz	preamp	Correction, dB	Margin, dB	Limit, dBµV/m
33.30000	24.5	15	120	on	11.8	-15.5	40.0
39.62500	32.0	15	120	on	13.3	-8.0	40.0
40.35000	31.8	15	120	on	13.5	-8.2	40.0
45.77500	23.1	15	120	on	14.4	-16.9	40.0
79.97500	28.3	15	120	on	8.2	-11.7	40.0
87.62500	29.4	15	120	on	9.9	-10.6	40.0
105.85000	31.2	15	120	on	12.4	-12.3	43.5
121.87500	35.5	15	120	on	9.9	-8.0	43.5
131.07500	41.3	15	120	on	8.9	-2.3	43.5
140.62500	37.7	15	120	on	8.4	-5.8	43.5
162.02500	32.7	15	120	on	8.8	-10.8	43.5
192.00000	37.3	15	120	on	10.7	-6.2	43.5
216.02500	38.5	15	120	on	11.3	-7.5	46.0
267.75000	37.7	15	120	on	12.6	-8.3	46.0
288.00000	32.8	15	120	on	12.8	-13.2	46.0
360.02500	30.7	15	120	on	14.4	-15.4	46.0
384.02500	34.6	15	120	on	14.7	-11.4	46.0
432.02500	35.8	15	120	on	15.3	-10.2	46.0
504.05000	30.2	15	120	on	16.4	-15.8	46.0
648.00000	33.9	15	120	on	18.4	-12.1	46.0
720.02500	31.5	15	120	on	19.5	-14.6	46.0
792.02500	32.7	15	120	on	20.3	-13.3	46.0
936.00000	32.0	15	120	on	21.6	-14.1	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 ±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 29, 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 than1 % of the emission bandwidth.

8.5.4 Test data

Table 8.5-1:*Frequency drift measurements results TGS small configuration*

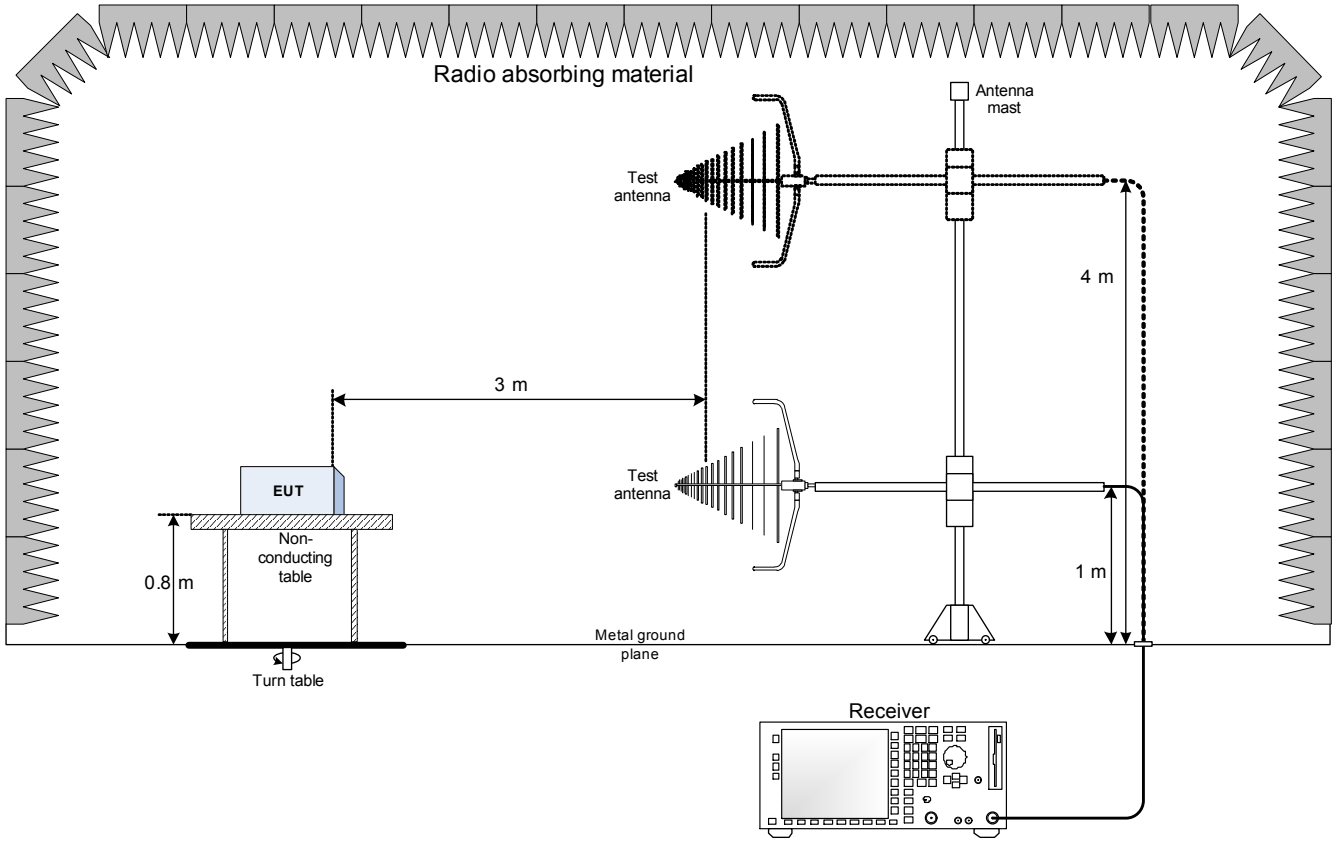
Test conditions	Frequency, MHz	Frequency drift, MHz	Frequency drift, %	Limit, ±%	Margin, %
+50 °C, Nominal	13.56200401	0.000887	0.0065391	0.01	0.0034609
+40 °C, Nominal	13.56200401	0.000887	0.0065391	0.01	0.00346086
+30 °C, Nominal	13.56200401	0.000887	0.0065391	0.01	0.0034609
+20 °C, +15 %	13.56110721	-0.000010	-0.0000739	0.01	0.01007389
+20 °C, Nominal	13.56111723	*Reference*	*Reference*	*Reference*	*Reference*
+20 °C, −15 %	13.56109719	-0.000020	-0.0001478	0.01	0.01014778
+10 °C, Nominal	13.56113727	2.004E-05	0.0001478	0.01	0.00985222
0 °C, Nominal	13.56111723	0	0.0000000	0.01	0.01
−10 °C, Nominal	13.56137776	0.0002605	0.0019212	0.01	0.00807885
−20 °C, Nominal	13.56162826	0.000511	0.0037683	0.01	0.00623165

Table 8.5-2:*Frequency drift measurements results TGS Big configuration*

Test conditions	Frequency, MHz	Frequency drift, MHz	Frequency drift, %	Limit, ±%	Margin, %
+50 °C, Nominal	13.56111723	-0.000100	-0.00073887	0.01	0.0107389
+40 °C, Nominal	13.56101703	-0.000200	-0.00147774	0.01	0.0114777
+30 °C, Nominal	13.56114228	-0.000075	-0.00055415	0.01	0.0105542
+20 °C, +15 %	13.56119238	-0.000025	-0.00018472	0.01	0.0101847
+20 °C, Nominal	13.56121743	*Reference*	*Reference*	*Reference*	*Reference*
+20 °C, −15 %	13.56111723	-0.000100	-0.00073887	0.01	0.0107389
+10 °C, Nominal	13.56099198	-0.0002254	-0.00166246	0.01	0.0116625
0 °C, Nominal	13.56111723	-0.0001002	-0.00073887	0.01	0.0107389
−10 °C, Nominal	13.56101703	-0.0002004	-0.00147774	0.01	0.0114777
−20 °C, Nominal	13.56111723	-0.0001002	-0.00073887	0.01	0.0107389

Section 9. Block diagrams of test set-ups

9.1 Radiated emissions set-up



9.2 Conducted emissions set-up