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Compliance test report ID **188676-1TRFWL**

Date of issue
November 2, 2011

FCC 47 CFR Part 15 Subpart C, §15.247

Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHz.

Applicant **SMS Audio**
Product **Sync by 50 dongle**
Model **Sync by 50 dongle**
FCC ID **Z6J-SMS001D**

Nemko Canada Inc., a testing laboratory, is accredited by the Standards Council of Canada. The tests included in this report are within the scope of this accreditation

SCC Accredited LAB
LAB Accrédité CCN

Test location

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November 2, 2011

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 Canada's ISO/IEC 17025 accreditation.

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Section 1 Report summary

1.1 Applicant and manufacturer

SMS Audio
2885 South Congress Avenue , Suite D
Delray Beach, Florida 33445
USA

1.2 Test specifications

FCC 47 CFR Part 15, Subpart C, Chapter 15.247

Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5875 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	Not applicable[1]
§15.31(m)	Number of operating frequencies	Pass[2]
§15.203	Antenna requirement	Pass

Notes:
[1] For battery-operated equipment, the equipment tests shall be performed using a new battery.
[2] Since the frequency band was wider than 10 MHz, three channels (1 near top – channel 15, 1 near middle – channel 7 and 1 near bottom – channel 1) were selected for the testing.

2.2 FCC Part 15 Subpart C – intentional radiators, test results

Part	Test description	Verdict
§15.247(a)(1)(i)	Frequency hopping systems operating in the 902–928 MHz band	Not applicable
§15.247(a)(1)(ii)	Frequency hopping systems operating in the 5725–5850 MHz band	Not applicable
§15.247(a)(1)(iii)	Frequency hopping systems operating in the 2400–2483.5 MHz band	Not applicable
§15.247(a)(2)	Minimum 6 dB bandwidth for systems using digital modulation techniques	Pass
§15.247(b)(1)	Maximum peak output power of frequency hopping systems operating in the 2400–2483.5 MHz band and 5725–5850 MHz band	Not applicable
§15.247(b)(2)	Maximum peak output power of Frequency hopping systems operating in the 902–928 MHz band	Not applicable
§15.247(b)(3)	Maximum peak output power of systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands	Not applicable
§15.247(b)(4)	Maximum peak output power	Pass
§15.247(c)(1)	Fixed point-to-point operation with directional antenna gains greater than 6 dBi	Not applicable
§15.247(c)(2)	Transmitters operating in the 2400–2483.5 MHz band that emit multiple directional beams	Not applicable
§15.247(d)	Spurious emissions	Pass
§15.247(e)	Power spectral density for digitally modulated devices	Pass
§15.247(f)	Time of occupancy for hybrid systems	Not applicable

Section 3 Equipment under test (EUT) details

3.1 Sample information

Receipt date	October 4, 2011
Nemko sample ID number	2

3.2 EUT information

Product name	Sync by 50 dongle
Model	Sync by 50 dongle
Serial number	N/A
Part number	SMS001D

3.3 Technical information

Operating band	2400–2483.5 MHz
Operating frequency	2403–2478 MHz
Modulation type	MSK
Occupied bandwidth	4.8 MHz (99 %)
Emission designator	G1D
Power requirements	Rechargeable battery (All tests were performed with fully charged battery.)
Antenna information	Rufa 2.4 GHz Internal SMD Antenna, 2.1 dBi gain. The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator.

3.4 Product description and theory of operation

Wireless dongle

3.5 EUT exercise details

EUT transmission was controlled via Kleer software where transmit channel was selected.

3.6 EUT setup diagram

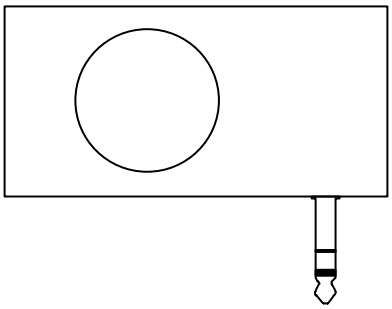


Diagram 3.6-1: Setup diagram

Section 4 Engineering considerations

4.1 Modifications incorporated in the EUT

The following modifications were performed by client: Coming out from KLR3012 pin 3 – Inductor to GND, value 3.3 nH (P/N LQG15HS3N3S02) and Series capacitor, value = 1.5 pF (P/N GJM1555C1H1R5B).

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: 86–106 kPa

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

Nemko Canada Inc. has calculated measurement uncertainty and is documented in EMC/MUC/001 “Uncertainty in EMC measurements.” Measurement uncertainty was calculated using the methods described in CISPR 16-4 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC measurements; as well as described in UKAS LAB34: The expression of Uncertainty in EMC Testing. Measurement uncertainty calculations assume a coverage factor of K=2 with 95% certainty.

Section 7 Test equipment

7.1 Test equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber	TDK	SAC-3	FA002047	1 year	Mar. 09/12
Flush mount turntable	Sunol	FM2022	FA002082	—	NCR
Controller	Sunol	SC104V	FA002060	—	NCR
Antenna mast	Sunol	TLT2	FA002061	—	NCR
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 26	FA002043	1 year	April 27/12
Bilog antenna	Sunol	JB3	FA002108	1 year	Jan. 31/12
Horn antenna #2	EMCO	3115	FA000825	1 year	Feb. 04/12
Horn antenna 18–40 GHz	EMCO	3116	FA001847	1 year	May 20/12
Note: NCR - no calibration required					

Section 8 Testing data

8.1 Clause 15.207(a) Conducted 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 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.

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
* - Decreases with the logarithm of the frequency.		

8.1.2 Test summary

Test date	October 11, 2011	**Test engineer**	Kevin Rose	**Verdict**	Pass
Temperature	23 °C	**Air pressure**	1002 mbar	**Relative humidity**	48 %

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.

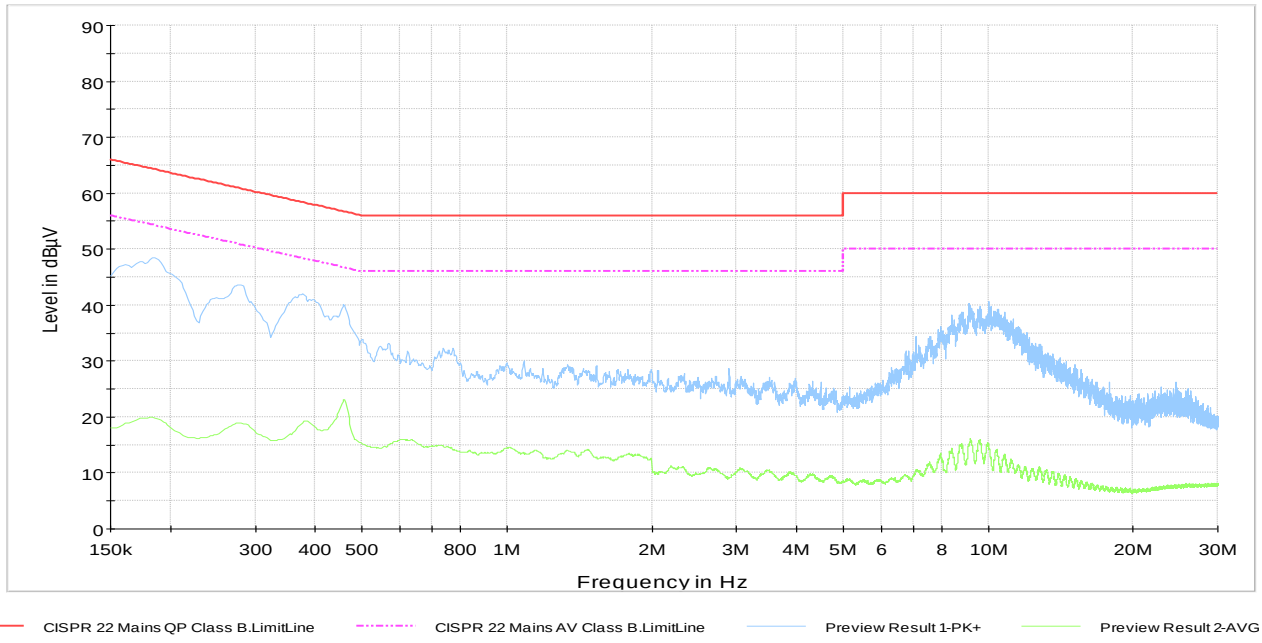
Receiver/spectrum analyzer settings

Preview measurements – Receiver:
Peak and Average detector (Max hold), RBW = 9 kHz, VBW = 30 kHz, Measurement time = 100 ms
Final measurements – Receiver:
Q-Peak and Average detector, RBW = 9 kHz, VBW = 30 kHz, Measurement time = 100 ms

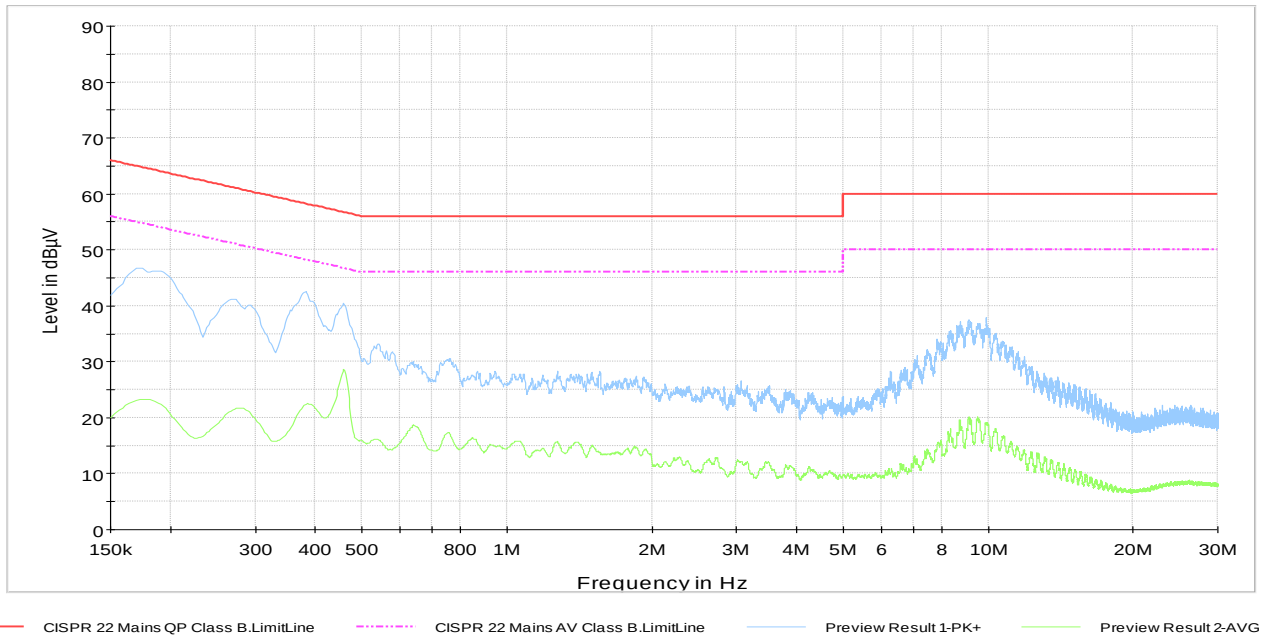
Measurement details

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

8.1.4 Test data



Plot 8.1-1: Conducted emissions on phase line



Plot 8.1-2: Conducted emissions on neutral line

8.2 Clause 15.247(a)(2) Minimum 6 dB bandwidth for systems using digital modulation techniques

8.2.1 Definitions and limits

§ 15.247 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.

(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(2) Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

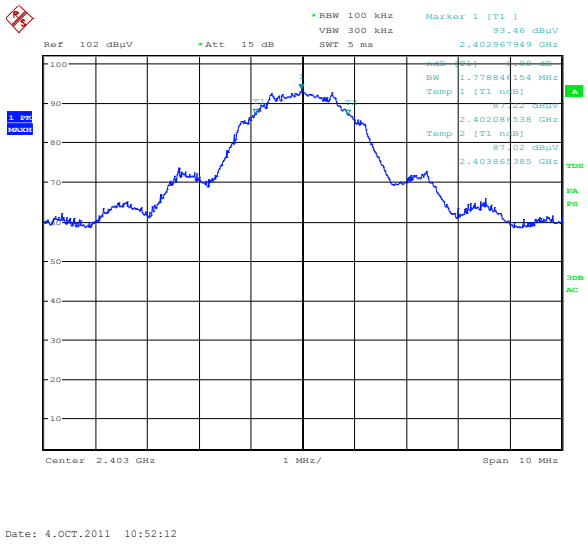
8.2.2 Test summary

Test date	October 4, 2011	**Test engineer**	Andrey Adelberg	**Verdict**	Pass
Temperature	22 °C	**Air pressure**	1000 mbar	**Relative humidity**	38 %

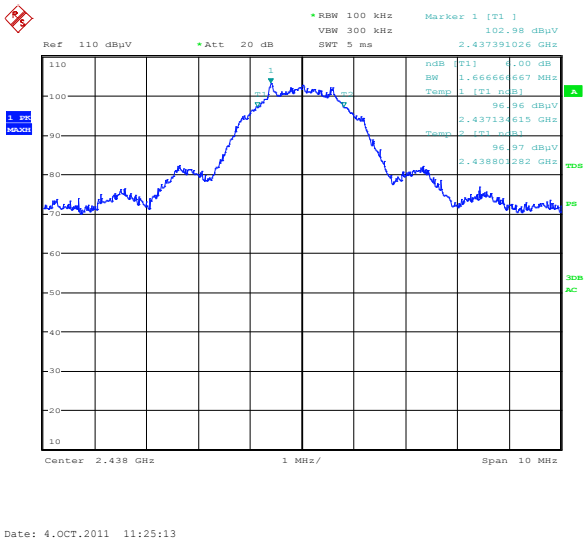
8.2.3 Observations/special notes

Measurements were performed with peak detector using 100 kHz RBW. VBW was set wider than RBW.

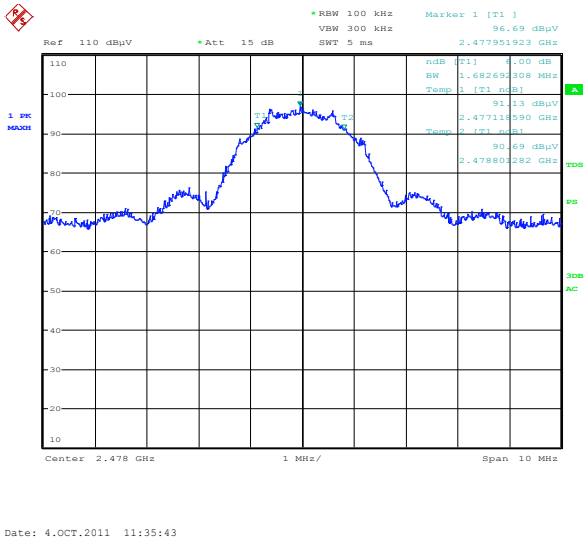
8.2.4 Test data



Plot 8.2-1: 6 dB bandwidth – Low channel



Plot 8.2-2: 6 dB bandwidth – Mid channel



Plot 8.2-3: 6 dB bandwidth – High channel

Table 8.2-1: 6 dB bandwidth results

Frequency (MHz)	6 dB bandwidth (MHz)	Limit (MHz)	Margin (MHz)
2403	1.78	> 0.5	1.28
2438	1.67	> 0.5	1.17
2478	1.68	> 0.5	1.18

8.3 Clause 15.247(b) Maximum peak conducted output power

8.3.1 Definitions and limits

§ 15.247 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.

(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:

(1) For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

(2) For frequency hopping systems operating in the 902–928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

(3) For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(i) Systems operating in the 2400–2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

(ii) Systems operating in the 5725–5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

Fixed, point-to-point operation, as used in paragraphs (b)(3)(i) and (b)(3)(ii) of this section, excludes the use of point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

8.3.2 Test summary

Test date	October 27, 2011	**Test engineer**	Andrey Adelberg	**Verdict**	Pass
Temperature	23 °C	**Air pressure**	1003 mbar	**Relative humidity**	30 %

8.3.3 Observations/special notes

The peak detector was used with RBW wider that 20 dB bandwidth.
The span was wider than RBW.

8.3.4 Test data

Section (3) Results

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 watt (30 dBm). As an alternative to a peak power measurement, compliance with the 1 watt (30 dBm) limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

- The test was performed using guidelines of ANSI C63.10-2009, Clause 6.10.2.1 and 6.10.2.2.
- Power option 1 was used for the power output measurements: RBW was set wider than emission bandwidth.
- Automatic settings were used for analyzer sweep time.

Radiated measurements were performed:

- The EUT was measured on three orthogonal axis.
- All measurements were performed at a distance of 3 m.
- All measurements were performed:
  - using a peak detector with RBW wider than emission bandwidth
- Only the worst data presented in the test report.
- Fully charged battery was used throughout the test.

Table 8.3-1: EIRP results

Frequency (MHz)	Field strength (dBµV/m)	EIRP (dBm)	Limit (dBm)	Margin (dB)
2403	96.85	1.62	36.0	34.38
2438	98.33	3.10	36.0	32.90
2478	98.84	3.61	36.0	32.39
EIRP [dBm] = Field Strength [dBµV/m] − 95.23 [dB]				

Theoretical conversion from Field Strength measured at 3 m to power conducted from the intentional radiator to the antenna:

$$P\ (W) = \frac{E^2 R^2}{30G}$$

E = Measured field strength value (V/m)
R = Measurement distance (m)
G = Antenna Gain (numeric)

Therefore dBW = dBV/m + 20×Log(3) – 10×Log(30) – 10×Log(G)

From which we obtain

dBmW = dBµV/m − 120 + 20×Log(3) − 10×Log(30) − 10×Log(G) + 30
= dBµV/m − 95.23 – 10×Log(G)

Output power [dBm] = Field Strength [dBµV/m] − 95.23 [dB] − Antenna gain [dBi]
EIRP [dBm] = Field Strength [dBµV/m] − 95.23 [dB]

Table 8.3-2: Output power results

Frequency (MHz)	EIRP (dBm)	Antenna gain (dBi)	Output power (dBm)	Limit (dBm)	Margin (dB)
2403	1.62	2.10	-0.48	30.0	30.48
2438	3.10	2.10	1.00	30.0	29.00
2478	3.61	2.10	1.51	30.0	28.49
Output power [dBm] = EIRP [dBm] − Antenna gain [dBi]					

8.4 Clause 15.247(d) Spurious emissions

8.4.1 Definitions and limits

15.247 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

8.4.2 Test summary

Test date	October 27, 2011	**Test engineer**	Andrey Adelberg	**Verdict**	Pass
Temperature	23 °C	**Air pressure**	1003 mbar	**Relative humidity**	30 %

8.4.3 Observations/special notes

Table 8.4-1: §15.209 – Radiated emission limits

Frequency (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance (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

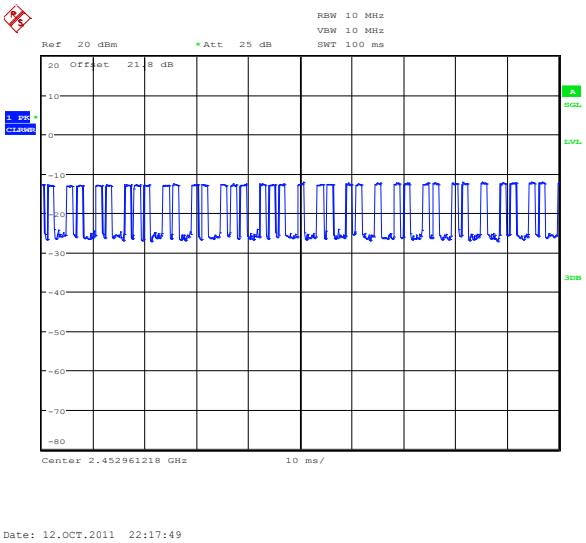
- The spectrum was searched from 30 MHz to the 10th harmonic. Only the worst case emissions shown. The rest was more than 20 dB below the specified limts.
- The EUT was measured on three orthogonal axis.
- All measurements were performed at a distance of 3 m.
- All measurements were performed:
- within 30–1000 MHz range: using a quasi-peak detector with 120 kHz/300 kHz RBW/VBW,
- above 1 GHz: using peak detector with 1 MHz/3 MHz RBW/VBW for peak results and using peak detector with 1 MHz/10 Hz RBW/VBW for average results and using a duty cycle/average factor for final average results calculations.

8.4.4 Test data

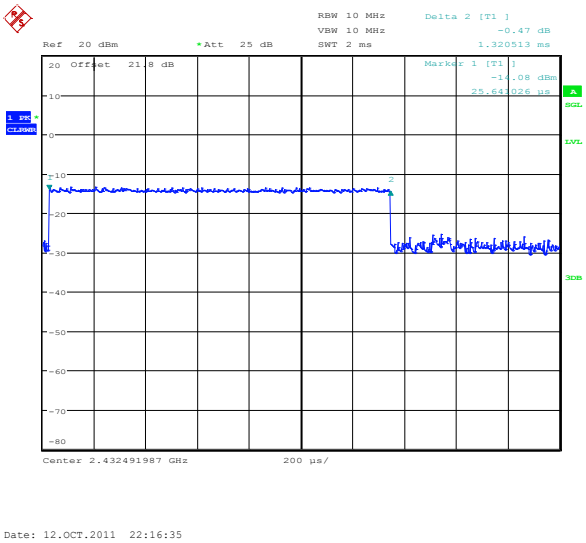
Duty cycle/average factor calculations

§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.

$$Duty\,cycle\,/\,average\,factor = 20 \times \log_{10}\left(\frac{Tx_{100\,ms}}{100\,ms}\right)$$

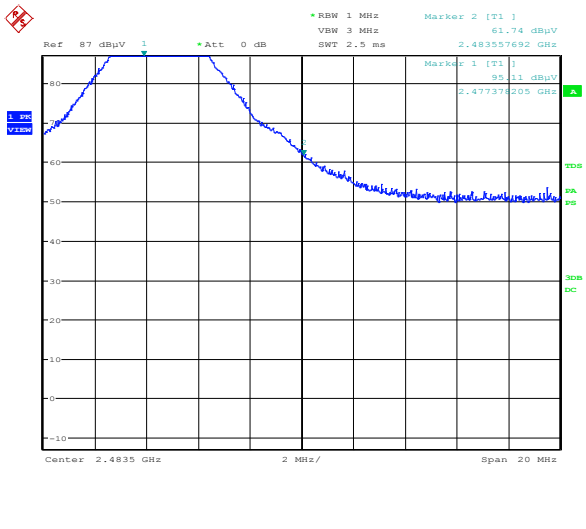


Plot 8.4-1: Number of pulses within 100 ms (36 pulses)

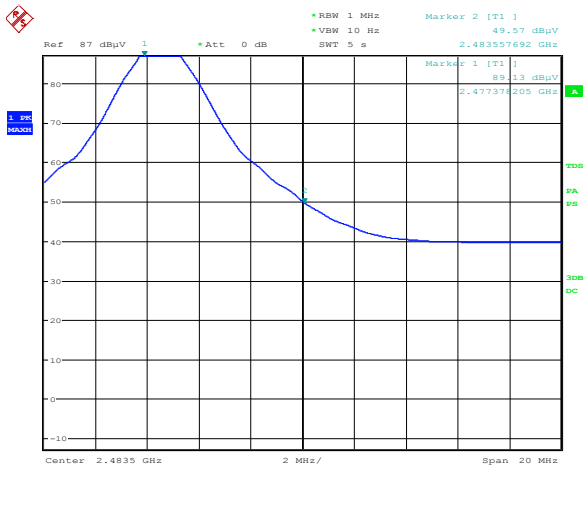


Plot 8.4-2: Pulse width (1.321 ms)

Duty cycle/average factor = 20 × Log_{10} (1.321 × 36 / 100) = −6.46 dB

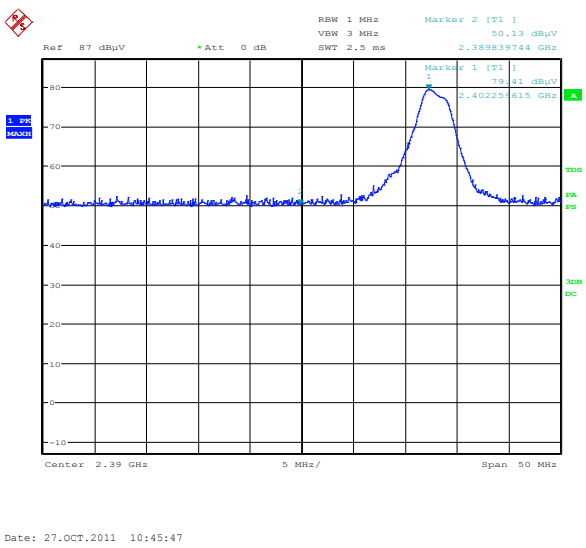


Plot 8.4-3: Upper band edge (peak)

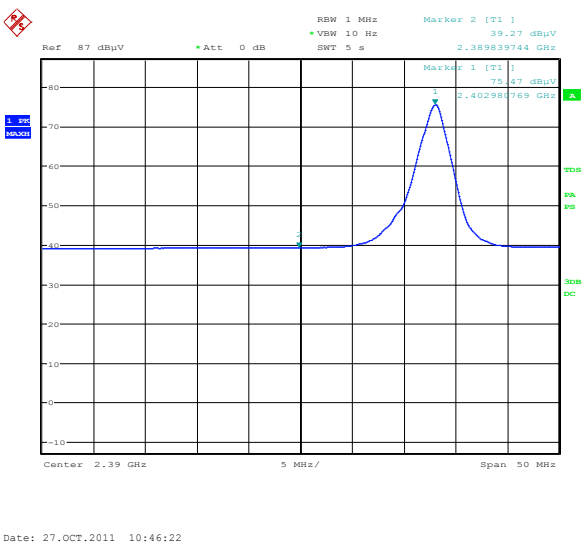


Plot 8.4-4: Upper band edge (average)

8.4.4 Test data, continued



Plot 8.4-5: Lower restricted band edge (peak)



Plot 8.4-6: Lower restricted band edge (average)

Table 8.4-2: Spurious emissions results

Measurement						Calculation			
Channel	**Frequency, (MHz)**	**Pk Field Strength, (dBµV/m)**	**Pk Limit, (dBµV/m)**	**Pk Margin, (dB)**	**Av Field strength, (dBµV/m)**	**Average factor, (dB)**	**Final Av Field strength, (dBµV/m)**	**Av Limit, (dBµV/m)**	**Av Margin, (dB)**
Low	4805.9	65.01	74.00	8.99	55.32	-6.46	48.86	54.00	5.14
Mid	4868.6	64.83	74.00	9.17	54.91	-6.46	48.45	54.00	5.55
High	4950.3	59.09	74.00	14.91	48.52	-6.46	42.06	54.00	11.94
Final average field strength = Average field strength (100 % duty cycle) + Average factor									

Table 8.4-3: Band edge results

Measurement						Calculation			
Channel	**Frequency, (MHz)**	**Pk Field Strength, (dBµV/m)**	**Pk Limit, (dBµV/m)**	**Pk Margin, (dB)**	**Av Field strength, (dBµV/m)**	**Average factor, (dB)**	**Final Av Field strength, (dBµV/m)**	**Av Limit, (dBµV/m)**	**Av Margin, (dB)**
Low	2390.0	50.13	74.00	23.87	39.27	-6.46	32.81	54.00	21.19
High	2483.5	61.74	74.00	12.26	49.57	-6.46	43.11	54.00	10.89

8.5 Clause 15.247(e) Power spectral density for digitally modulated devices

8.5.1 Definitions and limits

§ 15.247 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.

(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

- The test was performed using guidelines of ANSI C63.10-2009, Clause 6.11.2.

- PSD option 1 was used since output power option 1 was used.
- Emission peak was located and zoomed in. RBW was set to 3 kHz, VBW was set > RBW. Sweep time was set to Span/3 kHz. Peak level was measured.
- PSD option 2 was used since output power option 2 was used.
- Emission peak was located and zoomed in. RBW was set to 3 kHz, VBW was set to ≥9 kHz. Sweep time was set to automatic. (Sample detector was used due to bin width < 0.5 RBW and transmission pulse remained at maximum transmit power throughout 100 sweeps of averaging.) Peak detector was used. Average tracing over 100 sweeps in power averaging mode.

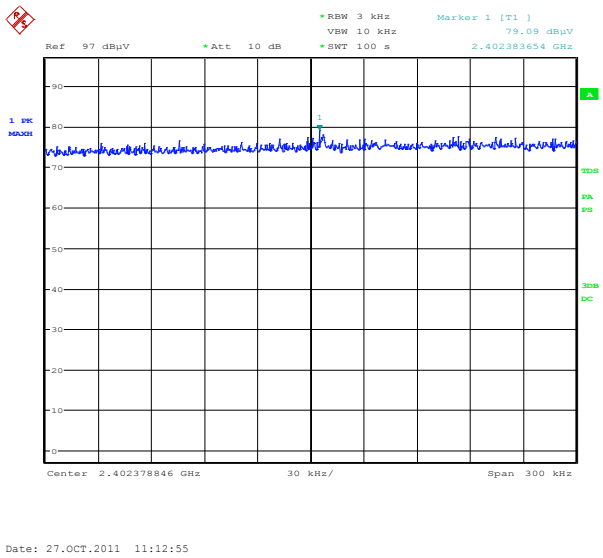
8.5.2 Test summary

Test date	October 27, 2011	**Test engineer**	Andrey Adelberg	**Verdict**	Pass
Temperature	23 °C	**Air pressure**	1003 mbar	**Relative humidity**	30 %

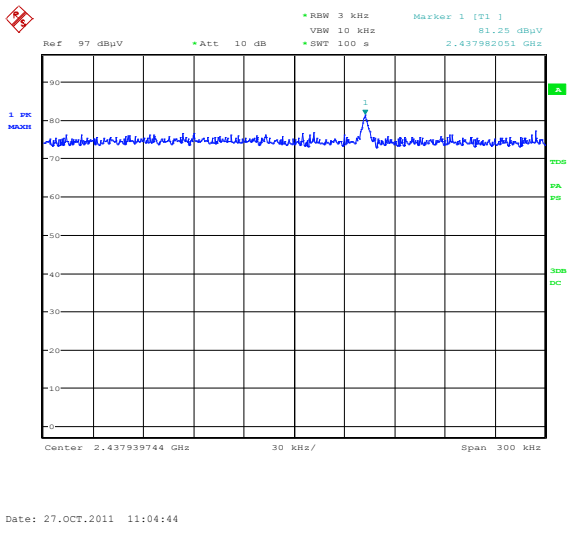
8.5.3 Observations/special notes

Sweep time was set to value of Span / RBW. Sweep time was set to 100 s (300 kHz / 3 kHz)

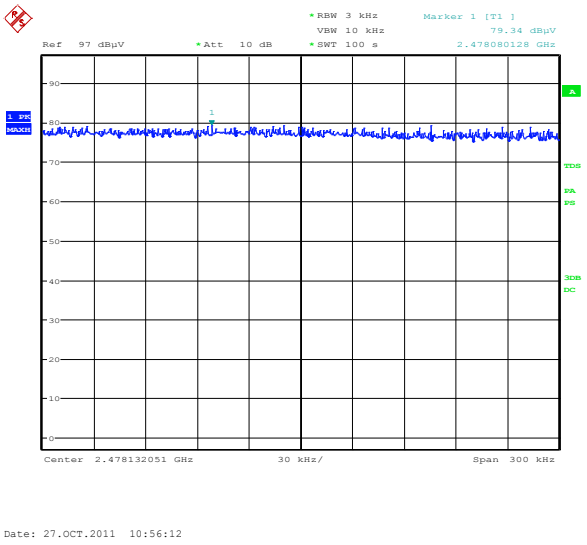
8.5.4 Test data



Plot 8.5-1: PSD low channel



Plot 8.5-2: PSD mid channel



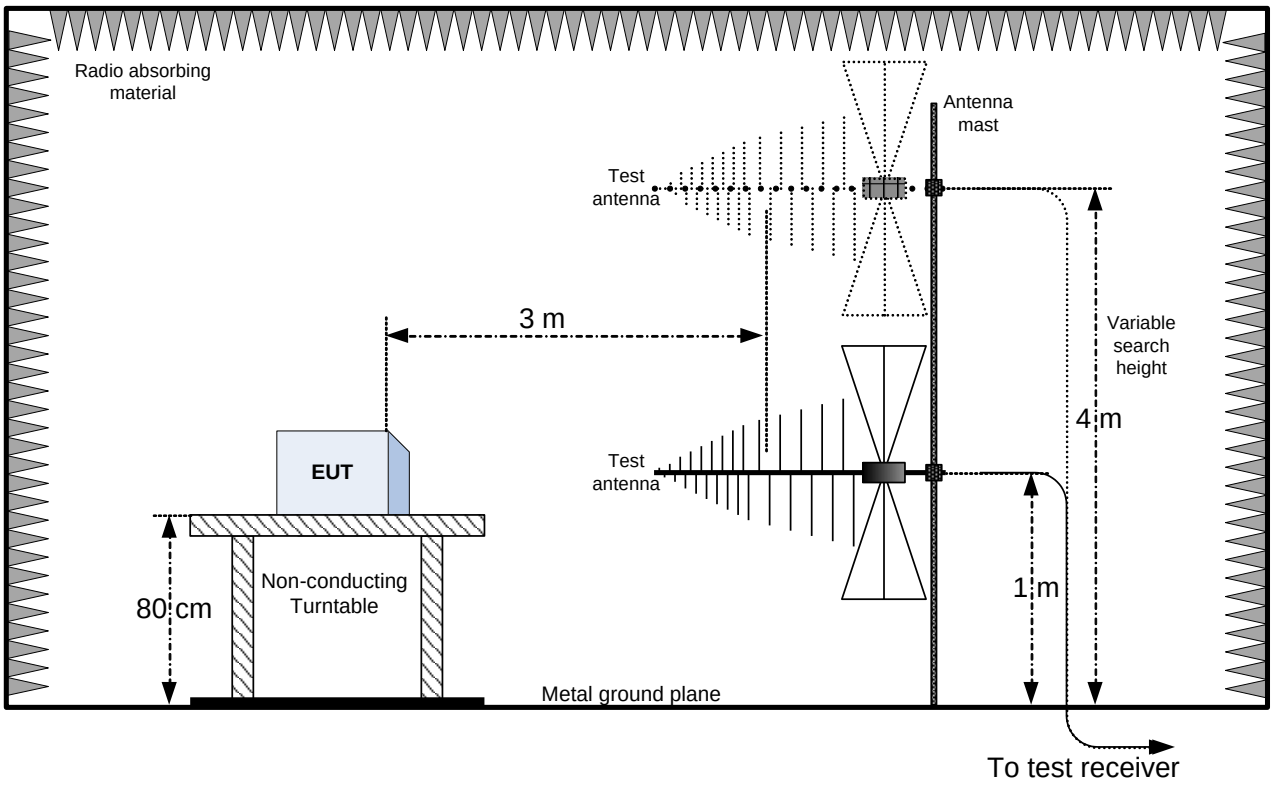
Plot 8.5-3: PSD high channel

Table 8.5-1: PSD results

Channel	Field strength (dBµV/m/3 kHz)	EIRP PSD (dBm/3 kHz)	Antenna gain (dBi)	PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)
Low	79.09	-16.14	2.1	-18.24	8.00	26.24
Mid	81.25	-13.98	2.1	-16.08	8.00	24.08
High	79.34	-15.89	2.1	-17.99	8.00	25.99
PSD [dBm] @ 3 m = Field Strength [dBµV/m] − 95.23 [dB] – antenna gain [dBi]						

Section 9 Block diagrams of test set-ups

9.1 Radiated emissions set-up



9.2 Conducted emissions set-up