CETECOM ICT Services GmbH

Radio Satellite Communication
Untertürkheimer Straße 6-10 . D-66117 Saarbrücken Telephon: +49 (0)681 598-0 Telefax: -9075

Recognized by the
Federal Communications Commission
FCC–Identification Number: 90462
TCB ID: DE 0001

Anechoic chamber registration no.: 3463 (IC)

Accredited by the
German Accreditation Council
DAR–Registration Number
TTI–P–G 166/98

Independent ETSI
compliance test house

Accredited Bluetooth™ Test Facility (BQTF)

Test Report No.: 2_3696-01-04/04
FCC Part 74.861 / CANADA RSS-123
SK 2015 / EK 2015
FCC ID : DMOB2AUWG
IC : 2099A-SK2015

CETECOM – ICT Services GmbH
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1 General Information

1.1 Notes

The test results of this test report relate exclusively to the test item specified in 1.5. The CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the CETECOM ICT Services GmbH.

Test Laboratory Manager:

2004-07-26	**RSC8411**	**Berg M.**	
Date	**Section**	**Name**	**Signature**

Technical Responsibility for Area of Testing:

2004-07-26	**RSC8412**	**Hausknecht D.**	
Date	**Section**	**Name**	**Signature**

1.2 Testing Laboratory

CETECOM ICT Services GmbH
Untertürkheimer Straße 6 - 10
66117 Saarbrücken
Germany
Telephone : + 49 681 598 - 0
Telefax : + 49 681 598 - 9075
E-mail : info@ict.cetecom.de
Internet : www.cetecom-ict.de

Accredited testing laboratory
The Test laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025.
DAR-registration number : TTI-P-G 166/98-30
Accredited Bluetooth™ Test Facility (BQTF)
BLUETOOTH is a trademark owned by Bluetooth SIG, Inc. and licensed to CETECOM

1.3 Details of Applicant

Name : Sennheiser electronic GmbH & Co. KG
Street : Am Labor 1
City : D-30900 Wedemark
Country : Germany
Telephone : +49 (0) 5130 600-0
Telefax : +49 (0) 5130 600-324
Contact : Mr. Volker Bartsch
Telephone : +49 (0) 5130 600-542
E-mail : bartschv@sennheiser.com

1.4 Application Details

Date of receipt of application : 2004-07-05
Date of receipt of test item : 2004-07-05
Date of test : 2004-07-19 to 2004-07-20

1.5 TEST ITEM

Type of equipment	:	Low power auxiliary equipment
Type designation		**Tx: SK 2015**
	:	**Rx: EK 2015**
Manufacturer	:	**Sennheiser electronic GmbH & Co. KG**
Street	:	**Am Labor 1**
City	:	**D-30900 Wedemark**
Country	:	**Germany**
Serial number	:	100035, 100041, 100043, 100047, 100053, 100022
Additional information	:	
Frequency	:	**518 MHz – 870 MHz (518-608 MHz and 614-806 MHz)**
Type of modulation	:	116KF3E (2x max. Audio Frequency + 2x max. FM Deviation)
Number of channels	:	**1440 (in 25 kHz steps)**
Antenna	:	Fixed mounted Lambda/4 antenna
Power supply	:	**2x1.5V DC Battery**
Output power	:	max 10 mW
Field strength	:	107.5 dBµV/m in 3m
Occupied bandwidth	:	89.2 kHz
Transmitter spurious	:	-39.5 dBm
Receiver spurious	.	44.6 µV7M in 3m (noise floor)
Temperature range	:	-30°C - +50°C
FCC ID	:	**DMOB2AUWG**
IC	:	**2099A-SK2015**

DECLARATION OF COMPLIANCE: I declare that the testing was performed or supervised by me; that the test measurements were made in accordance with the above-mentioned Industry Canada standard(s); and that the equipment
identified in this application has been subjected to all the applicable test conditions specified in the Industry Canada standards and all of the requirements of the standard have been met.

Signature: _____

Date: 2004-07-19 Michael Berg ; Test management
NAME AND TITLE (Please print or type):

1.6 Test Specifications:

FCC Part 74 Subpart H
CANADA RSS-123

2 Technical Test

2.1 Summary of Test Results

TEST PROCEDURE

All tests were done in accordance with the EIA/TIA 603.

THE SUBSTITUTION METHOD (TIA/EIA 603) WAS USED.

This products fulfills also the requirements for CANADA RSS-123

No deviations from the technical specification(s) were ascertained in the course of the tests performed.

Final verdict : PASS

2.2 Test report

TEST REPORT

Test report no.: 2_3696-01-04/04

TEST REPORT REFERENCE

LIST OF MEASUREMENTS

Equipment under test : SK 2015
Ambient temperature : 25.6°C
Relative humidity : 59%

OUTPUT POWER (radiated) FCC Rule Part 74.861 (e)(1)(ii)

Method of measurement:

Measuring the EIRP of Spurious/Harmonic Emissions using Substitution Method

(a) The measurements was performed with full rf output power and modulation.
(b) Test was performed at listed 3m test site (listed with FCC, IC).
(c) The transmitter under test was placed at the specified height on a non-conducting turntable (80 cm height)
(d) The BICONILOG antenna (20 MHz to 1 GHz) or HORN antenna (1 GHz to 18 GHz) was used for measuring.
(e) Load an appropriate correction factors file in EMI Receiver for correcting the field strength reading level
Total Correction Factor recorded in the EMI Receiver = Cable Loss + Antenna Factor
E (dBuV/m) = Reading (dBuV) + Total Correction Factor (dB/m)
(f) Set the EMI Receiver and #2 as follows:

Center Frequency: test frequency
Resolution BW: 100 kHz
Video BW: same
Detector Mode: positive
Average: off
Span: 3 x the signal bandwidth

(g) The test antenna was lowered or raised from 1 to 4 meters until the maximum signal level was detected.
(h) The transmitter was rotated through 360 o about a vertical axis until a higher maximum signal was received.
(i) The test antenna was lowered or raised again from 1 to 4 meters until a maximum was obtained. This level was recorded.
(j) The recorded reading was corrected to the true field strength level by adding the antenna factor, cable loss and subtracting the pre-amplifier gain.
(k) The above steps were repeated with both transmitters' antenna and test receiving antenna placed in vertical and horizontal polarization. Both readings with the antennas placed in vertical and horizontal polarization shall be recorded.
(l) Repeat for all different test signal frequencies

Measuring the EIRP of Spurious/Harmonic Emissions using Substitution Method

(a) Set the EMI Receiver (for measuring E-Field) and Receiver #2 (for measuring EIRP) as follows:

Center Frequency	: equal to the signal source
Resolution BW	: 10 kHz
Video BW	: same
Detector Mode	: positive
Average	: off
Span	: 3 x the signal bandwidth

(b) Load an appropriate correction factors file in EMI Receiver for correcting the field strength reading level
Total Correction Factor recorded in the EMI Receiver = Cable Loss + Antenna Factor
E (dBuV/m) = Reading (dBuV) + Total Correction Factor (dB/m)
(c) Select the frequency and E-field levels for ERP/EIRP measurements.
(d) Substitute the EUT by a signal generator and one of the following transmitting antenna (substitution antenna):
.DIPOLE antenna for frequency from 30-1000 MHz or .HORN antenna for frequency above 1 GHz }.

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17-24

Equipment under test : SK 2015
Ambient temperature : 25.6°C
Relative humidity : 59%

(e) Mount the transmitting antenna at 1.5 meter high from the ground plane.
(f) Use one of the following antenna as a receiving antenna: .DIPOLE antenna for frequency from 30-1000 MHz or .HORN antenna for frequency above 1 GHz }.
(g) If the DIPOLE antenna is used, tune it's elements to the frequency as specified in the calibration manual.
(h) Adjust both transmitting and receiving antenna in a VERTICAL polarization.
(i) Tune the EMI Receivers to the test frequency.
(j) Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.
(k) The transmitter was rotated through 360 o about a vertical axis until a higher maximum signal was received.
(l) Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.
(m) Adjust input signal to the substitution antenna until an equal or a known related level to that detected from the transmitter was obtained in the test receiver.
(n) Record the power level read from the Average Power Meter and calculate the ERP/EIRP as follows:
P = P1 - L1 = (P2 + L2) – L1 = P3 + A + L2 - L1
EIRP = P + G1 = P3 + L2 - L1 + A + G1
ERP = EIRP – 2.15 dB
Total Correction factor in EMI Receiver # 2 = L2 – L1 + G1
Where: P: Actual RF Power fed into the substitution antenna port after corrected.
P1: Power output from the signal generator
P2: Power measured at attenuator A input
P3: Power reading on the Average Power Meter
EIRP: EIRP after correction
ERP: ERP after correction
(o) Adjust both transmitting and receiving antenna in a HORIZONTAL polarization, then repeat step (k) to (o)
(p) Repeat step (d) to (o) for different test frequency
(q) Repeat steps (c) to (j) with the substitution antenna oriented in horizontal polarization.
(r) Actual gain of the EUT's antenna is the difference of the measured EIRP and measured RF power at the RF port. Correct the antenna gain if necessary.:

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17-24

Equipment under test : SK 2015
Ambient temperature : 25.6°C
Relative humidity : 59%

Results:

TEST CONDITIONS		TRANSMITTER ERP (mW)					
Frequency (MHz)		518.150	643.850	757.850	803.550	863.800	
T_{nom}(23)°C	3.0 V	2.3	10.0	10.0	3.2	5.1	7.8
antenna gain		0 dB					
Maximum deviation from output power under extreme test conditions (dBc)		±0.2 dB					
Measurement uncertainty		±0.5dB					

Sample calculation:

Freg	SA Reading	SG Setting	Ant. gain	Dipol gain	Cable loss	ERP Result			
MHz	dBµV	dBm	dBi	dBd	dB	dBm			
758.0	79.5	12.9	-	0.0	2.9	10.0			

ERP = SG (dBm) - Cable Loss (dB) + Ant. gain (dBd)

LIMIT **FCC Rule Part 74.861**

Frequency range MHz	Power level conducted mW
54-72, 76-88, 174-216	50
470-608, 614-806	250

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17-24

Equipment under test : SK 2015
Ambient temperature : 25.6°C
Relative humidity : 59%

AFC FREQ ERROR vs. VOLTAGE **FCC Rule Part 74.861**

Method of measurement:

The EUT was fixed in test fixture to a resistive coaxial attenuator of normal load impedance, and the un-modulated carrier was measured by means of a spectrum analyzer .
The input voltage was varied in an range from 2.2V to 3.1V and the maximum change in frequency was noted within one minute.
The temperature tests were performed for each frequency range on one channel

518.150 MHz

Voltage (V)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
2.2	760	0,00014668	1,4668
2.4	760	0,00014668	1,4668
2.6	760	0,00014668	1,4668
2.8	760	0,00014668	1,4668
3.0	760	0,00014668	1,4668
3.1	760	0,00014668	1,4668

643.850 MHz

Voltage (V)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
2.2	1940	0,00030131	3,0131
2.4	1940	0,00030131	3,0131
2.6	1820	0,00028267	2,8267
2.8	2070	0,00032150	3,2150
3.0	2070	0,00032150	3,2150
3.1	1820	0,00028267	2,8267

757.850 MHz

Voltage (V)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
2.2	-310	-0,00004091	-0,4091
2.4	-310	-0,00004091	-0,4091
2.6	-310	-0,00004091	-0,4091
2.8	-310	-0,00004091	-0,4091
3.0	-310	-0,00004091	-0,4091
3.1	-430	-0,00005674	-0,5674

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64 ;05

Equipment under test : SK 2015
Ambient temperature : 25.6°C
Relative humidity : 59%

803.550 MHz

Voltage (V)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
2.2	810	0,00010080	1,0080
2.4	810	0,00010080	1,0080
2.6	810	0,00010080	1,0080
2.8	810	0,00010080	1,0080
3.0	810	0,00010080	1,0080
3.1	810	0,00010080	1,0080

864.800 MHz

Voltage (V)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
2.2	1840	0,00021277	2,1277
2.4	2070	0,00023936	2,3936
2.6	2190	0,00025324	2,5324
2.8	2070	0,00023936	2,3936
3.0	2070	0,00023936	2,3936
3.1	2070	0,00023936	2,3936

LIMIT **FCC Rule Part 74.861(4)**

The frequency tolerance of the transmitter shall be 0.005 percent

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64 ;05

Equipment under test : SK 2015
Ambient temperature : 25.6°C
Relative humidity : 59%

AFC FREQ ERROR vs. TEMPERATURE

Method of measurement:
The EUT was connected to a resistive coaxial attenuator of normal load impedance, and the un-modulated carrier was measured by means of a spectrum analyzer .
With all power removed, the temperature was decreased to –30°C and permitted to stabilize for three hours . Power was applied and the maximum change in frequency was noted within one minute.
With power OFF , the temperature was raised in 10°C steps. The sample was permitted to stabilize at each step for at least one-half hour. Power was applied and the maximum frequency error was noted within one minute .
The temperature tests were performed for each frequency range on one channel

518.150 MHz

TEMPERATURE (°C)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
-30	3120	0,00060214	6,0214
-20	2470	0,00047670	4,7670
-10	2180	0,00042073	4,2073
±0.0	1480	0,00028563	2,8563
+10	1450	0,00027984	2,7984
+20	760	0,00014668	1,4668
+30	650	0,00012545	1,2545
+40	50	0,00000965	0,0965
+50	80	0,00001544	0,1544

AFC FREQ ERROR vs. TEMPERATURE

643.850 MHz

TEMPERATURE (°C)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
-30	-980	-0,00015221	-1,5221
-20	850	0,00013202	1,3202
-10	2300	0,00035723	3,5723
±0.0	2300	0,00035723	3,5723
+10	1900	0,00029510	2,9510
+20	2070	0,00032150	3,2150
+30	1700	0,00026404	2,6404
+40	1700	0,00026404	2,6404
+50	1900	0,00029510	2,9510

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64 ;05

Equipment under test : SK 2015
Ambient temperature : 25.6°C
Relative humidity : 59%

757.850 MHz

TEMPERATURE (°C)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
-30	-9890	-0,00130501	-13,0501
-20	-7140	-0,00094214	-9,4214
-10	-2900	-0,00038266	-3,8266
±0.0	-1500	-0,00019793	-1,9793
+10	-100	-0,00001320	-0,1320
+20	-310	-0,00004091	-0,4091
+30	1100	0,00014515	1,4515
+40	1300	0,00017154	1,7154
+50	1900	0,00025071	2,5071

803.550 MHz

TEMPERATURE (°C)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
-30	-2100	-0,00026134	-2,6134
-20	-1270	-0,00015805	-1,5805
-10	-780	-0,00009707	-0,9707
±0.0	-50	-0,00000622	-0,0622
+10	590	0,00007342	0,7342
+20	810	0,00010080	1,0080
+30	940	0,00011698	1,1698
+40	940	0,00011698	1,1698
+50	1060	0,00013191	1,3191

864.800 MHz

TEMPERATURE (°C)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
-30	-720	-0,00008326	-0,8326
-20	1240	0,00014339	1,4339
-10	4100	0,00047410	4,7410
±0.0	3100	0,00035846	3,5846
+10	1900	0,00021970	2,1970
+20	2070	0,00023936	2,3936
+30	1500	0,00023297	2,3297
+40	1700	0,00026404	2,6404
+50	1700	0,00026404	2,6404

LIMIT **FCC Rule Part 74.861**

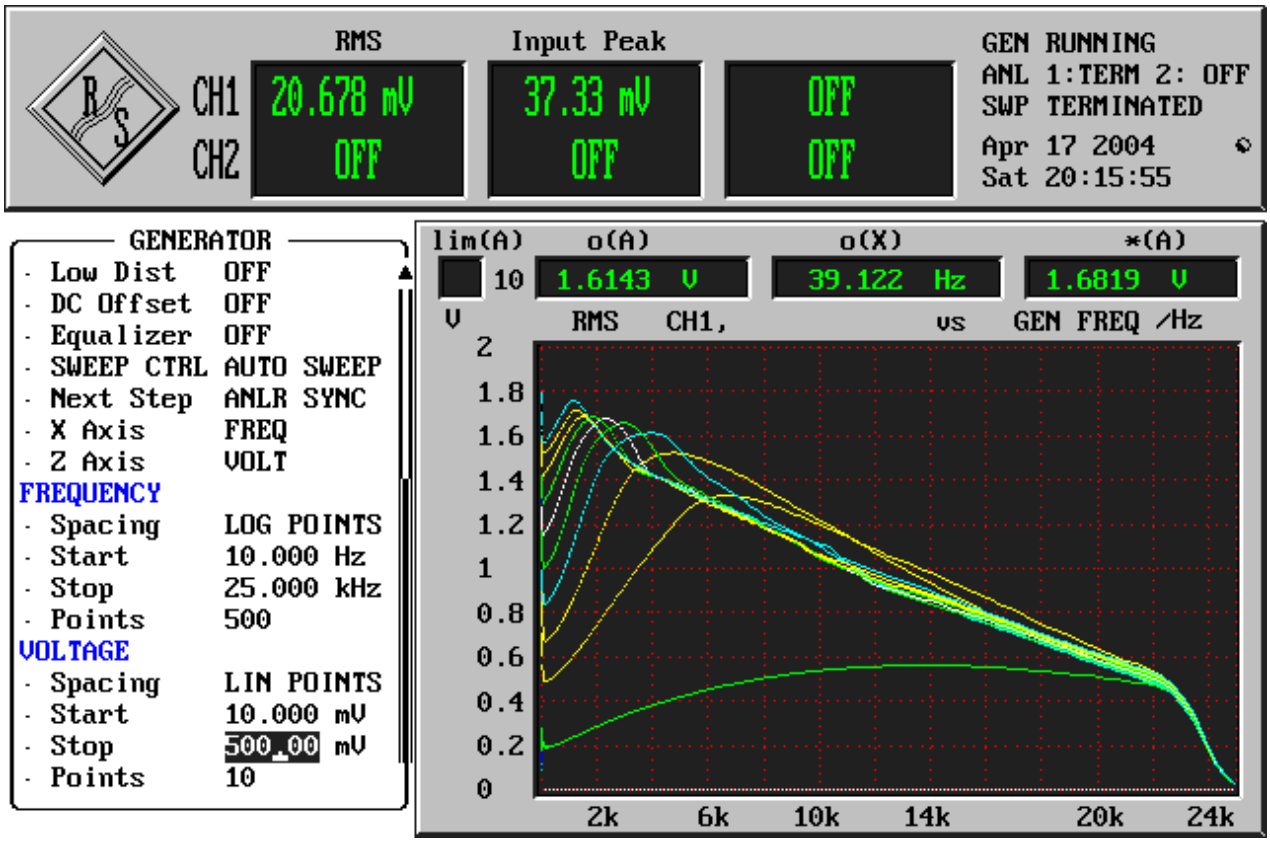
The frequency tolerance of the transmitter shall be 0.005 percent

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64 ;05

Equipment under test : SK 2015
Ambient temperature : 25.6°C
Relative humidity : 59%

CHARACTERISTICS OF THE AUDIO MODULATION CIRCUITRY
FCC Rule Part 74 .861(e3)

Method of measurement :
The audio frequency responds was measured in accordance with EIA/TIA 603.
The plots shows 10 curves with different modulation levels, starting from 0.01mV to 240 mV (30%+20 dB Modulation), the frequency is varied from 10 Hz to 25 kHz .



max. measured frequency deviation : 41.6 kHz

this measurement is valid for all channels

Limit: max Deviation ±75kHz

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64 ;05

Equipment under test : SK 2015
Ambient temperature : 25.6°C
Relative humidity : 59%

OCCUPIED BANDWIDTH FCC Rule Part 74.861(e)(3), (5)/ Sec. 2.1049

Test method :
The audio frequency responds was measured in accordance with EIA/TIA 603.

Data in the plots show that all sidebands between 50 &100% for the authorized bandwidth are attenuated by at least 25dB. From 100 to 250% of the authorize3d bandwidth they are attenuated by at least 35dB and beyond 250% 43 log(Po) dB. The plot shows the transmitter modulated with 15000 Hz(the highest modulation frequency), adjusted for 50% modulation plus 16 dB. The spectrum analyzer was set with the un-modulated carrier at the top of the screen. The test procedure diagram and occupied bandwidth plots follow.

TEST CONDITIONS		OCCUPIED BANDWIDTH (kHz)					
Frequency (MHz)		518.150	643.850	757.850	803.550	864.800	
T_{nom}(23)°C	V_{nom}(3.0)V	88.167	89.178	80.160	88.176	89.178	
max. Deviation (FM)		41.6 kHz					
Measurement uncertainty		±0.5%					

Limits **FCC Rule Part 74.861(e)(5)**

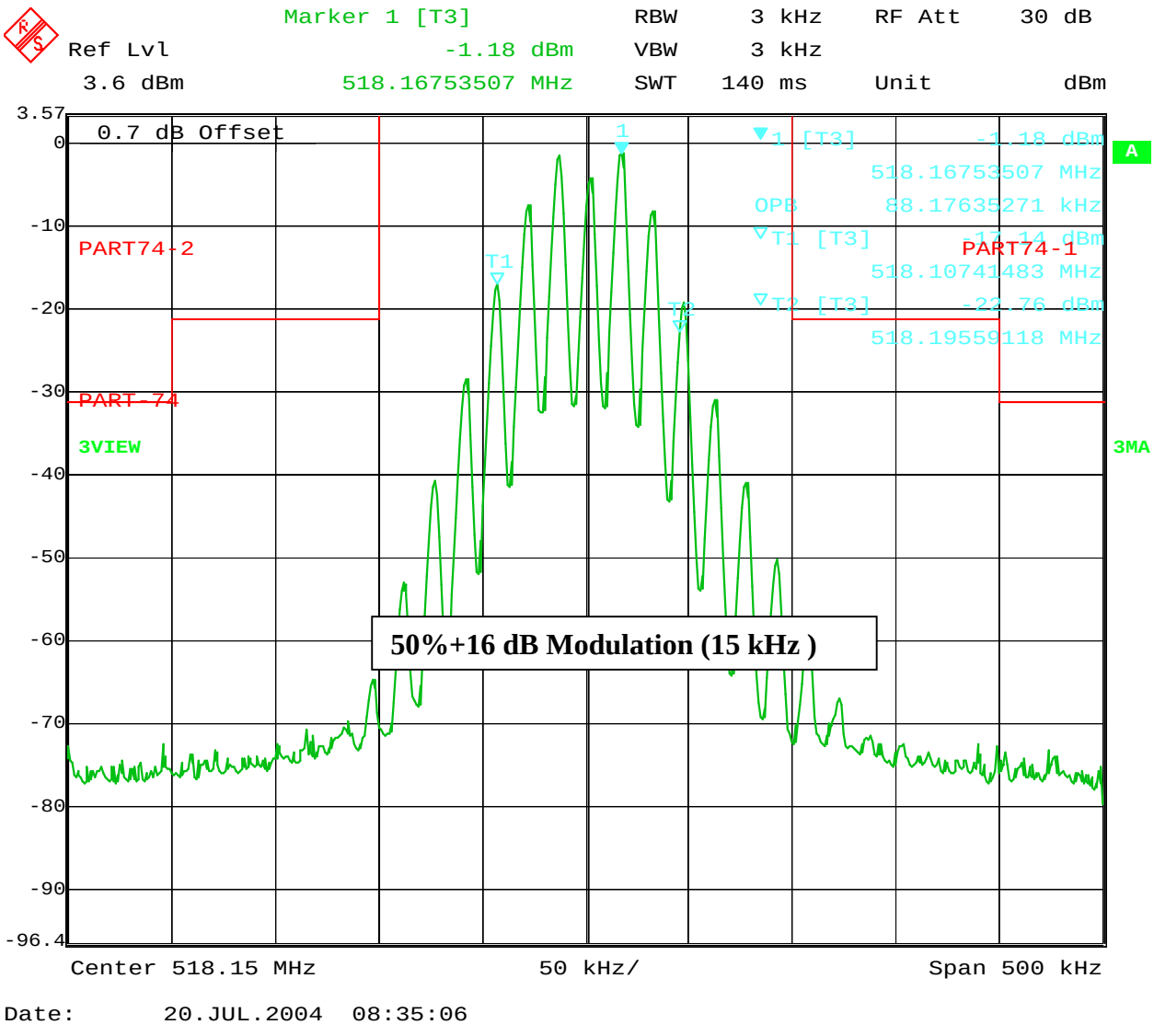
The operating bandwidth shall not exceed 200 kHz

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64 ;05

Equipment under test : SK 2015
Ambient temperature : 25.6°C
Relative humidity : 59%

OCCUPIED BANDWIDTH **FCC Rule Part 74.861(e)(3), (5)/ Sec. 2.989**

Frequency: 518.150 MHz / max. deviation : ± 41.2kHz (Limit ± 75 kHz)

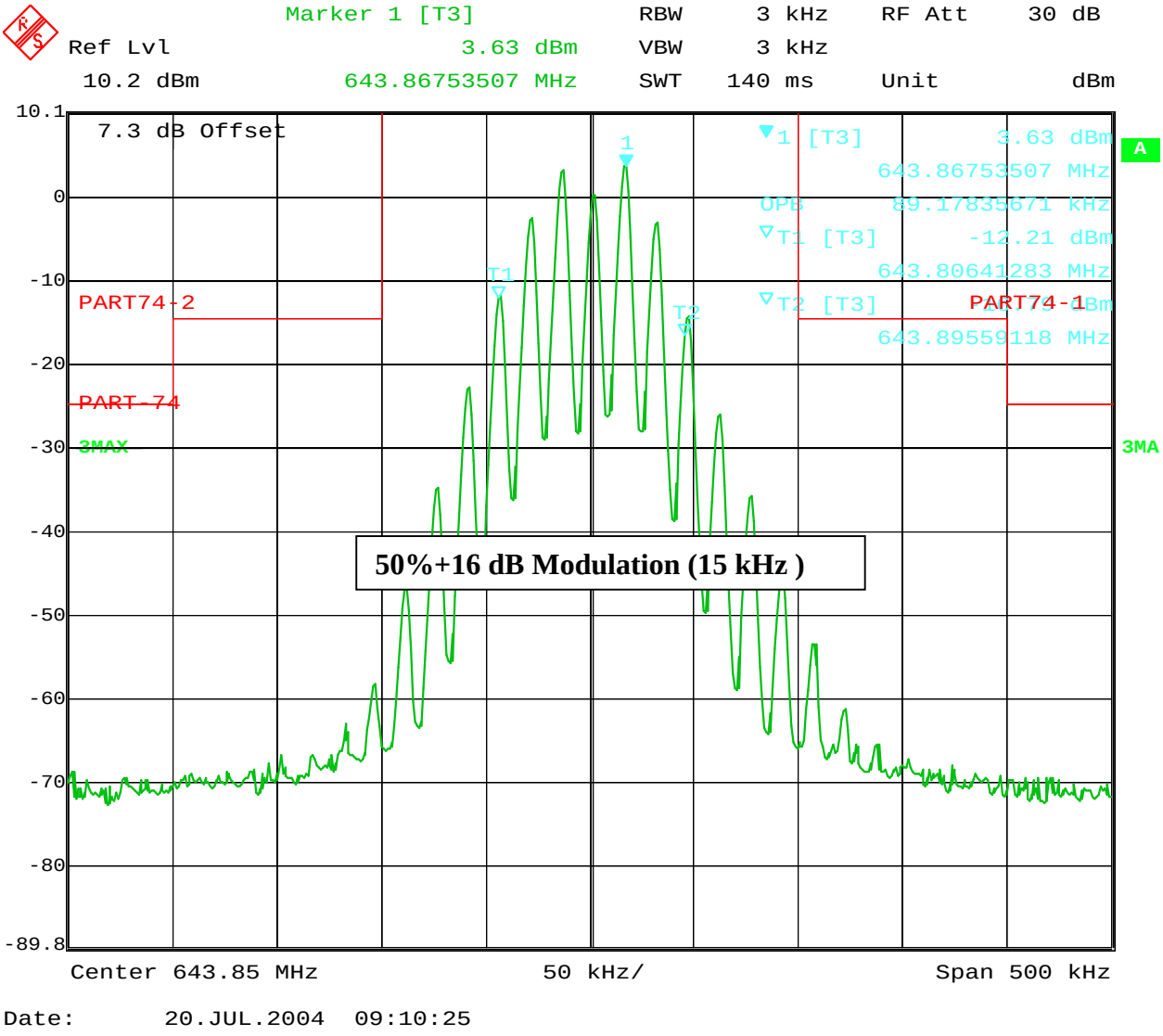


REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64 ;05

Equipment under test : SK 2015
Ambient temperature : 25.6°C
Relative humidity : 59%

OCCUPIED BANDWIDTH **FCC Rule Part 74.861(e)(3), (5)/ Sec. 2.1049**

Frequency: 643.850 MHz / max. deviation : ± 41.3 kHz (Limit ± 75 kHz)

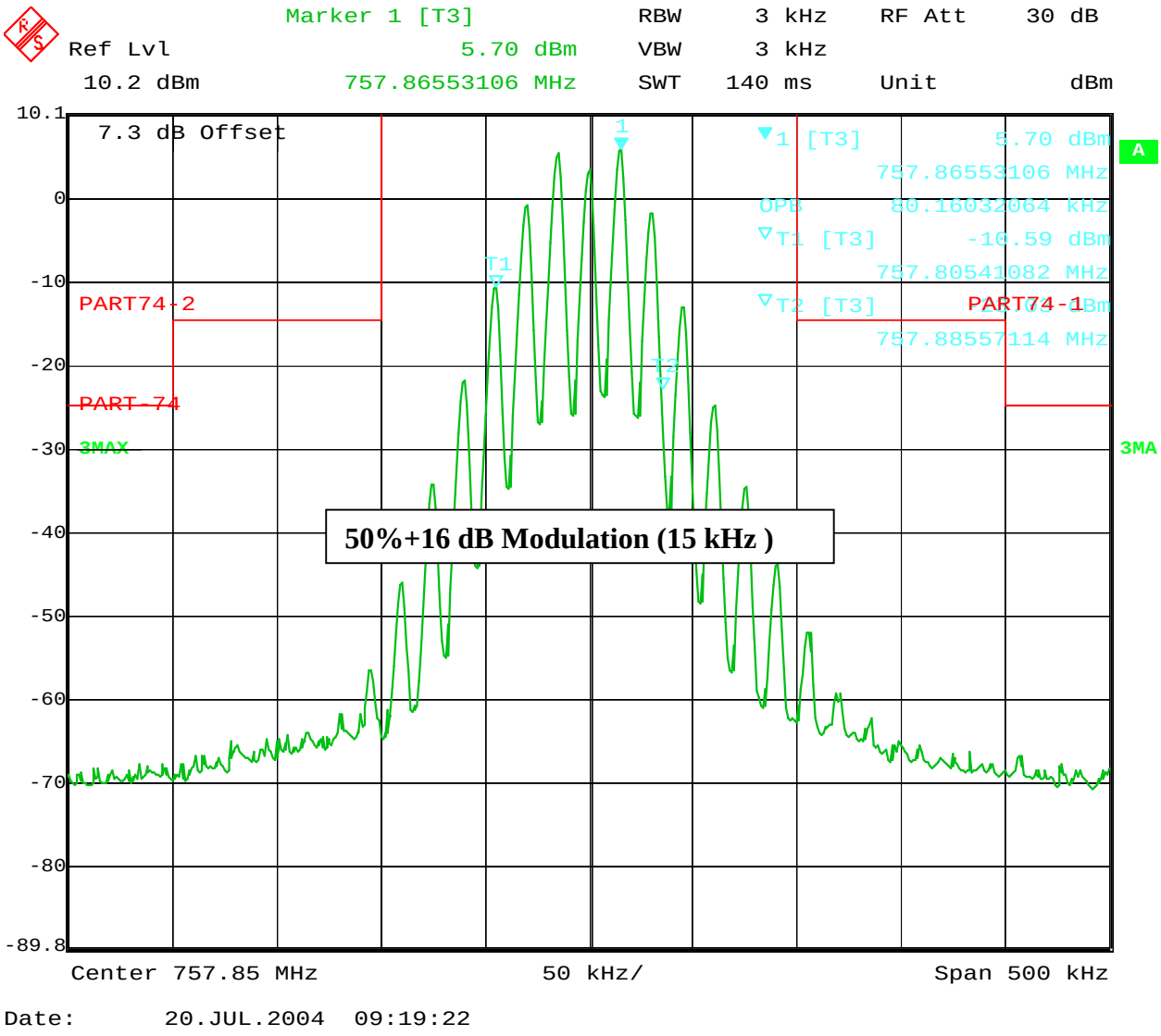


REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64 ;05

Equipment under test : SK 2015
Ambient temperature : 25.6°C
Relative humidity : 59%

OCCUPIED BANDWIDTH **FCC Rule Part 74.861(e)(3), (5)/ Sec. 2.1049**

Frequency: 757.850 MHz / max. deviation : ± 40.2 kHz (Limit ± 75 kHz)

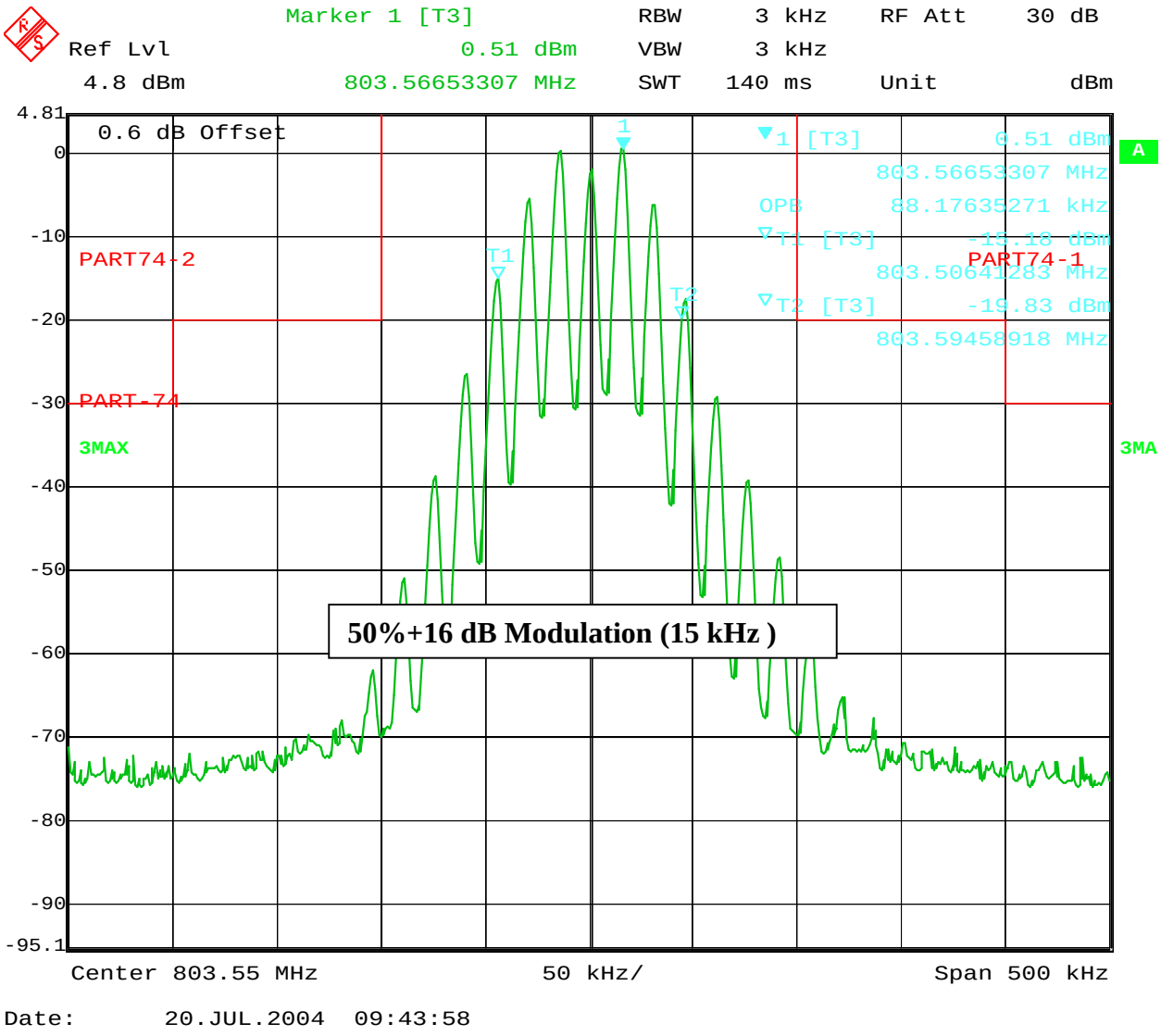


REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64 ;05

Equipment under test : SK 2015
Ambient temperature : 25.6°C
Relative humidity : 59%

OCCUPIED BANDWIDTH **FCC Rule Part 74.861(e)(3), (5)/ Sec. 2.989**

Frequency: 803.550 MHz / max. deviation : ± 40.6 kHz (Limit ± 75 kHz)

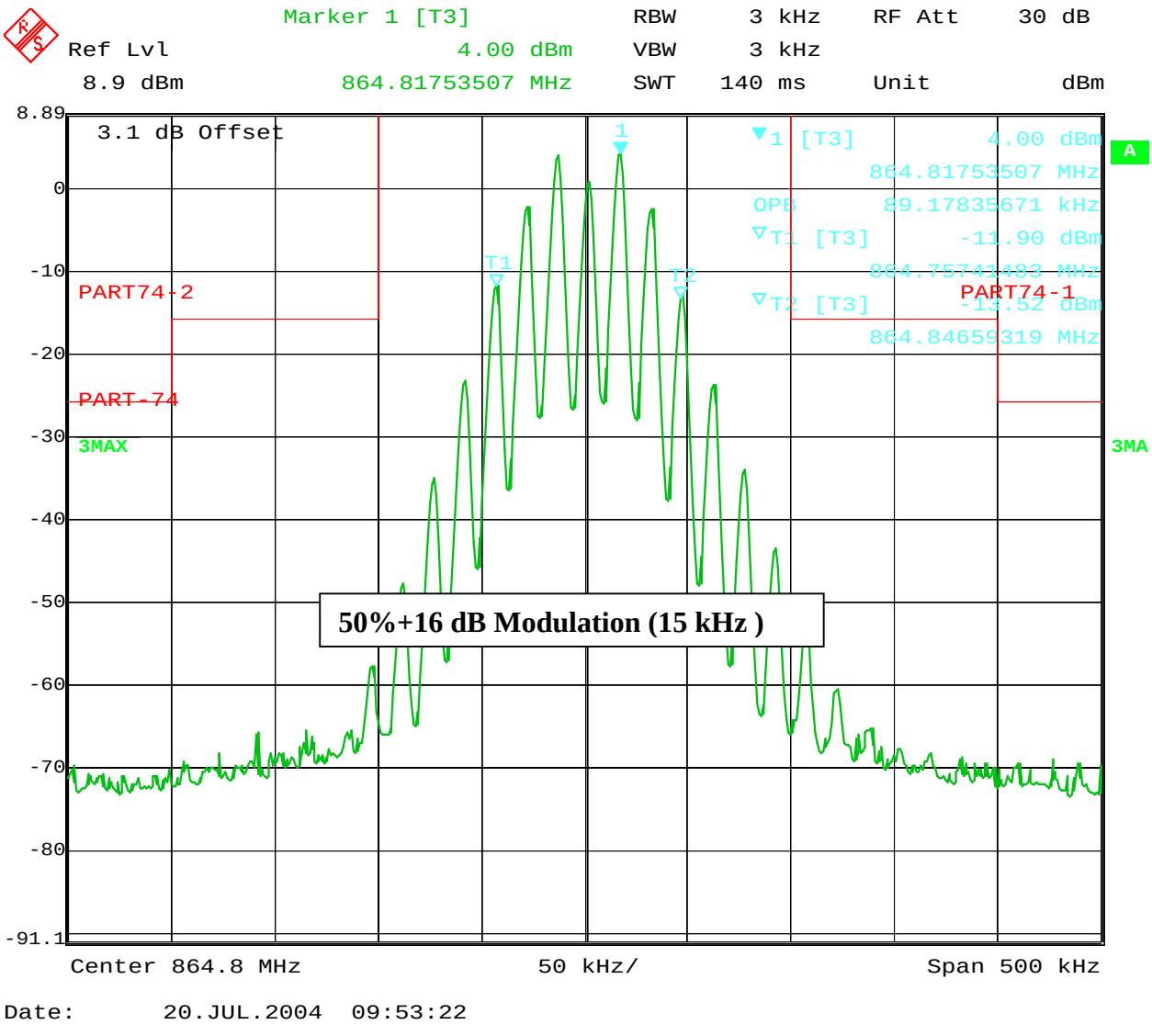


REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64 ;05

Equipment under test : SK 2015
Ambient temperature : 25.6°C
Relative humidity : 59%

OCCUPIED BANDWIDTH **FCC Rule Part 74.861(e)(3), (5)/ Sec. 2.1049**

Frequency: 864.800 MHz / max. deviation : ± 41.6 kHz (Limit ± 75 kHz)

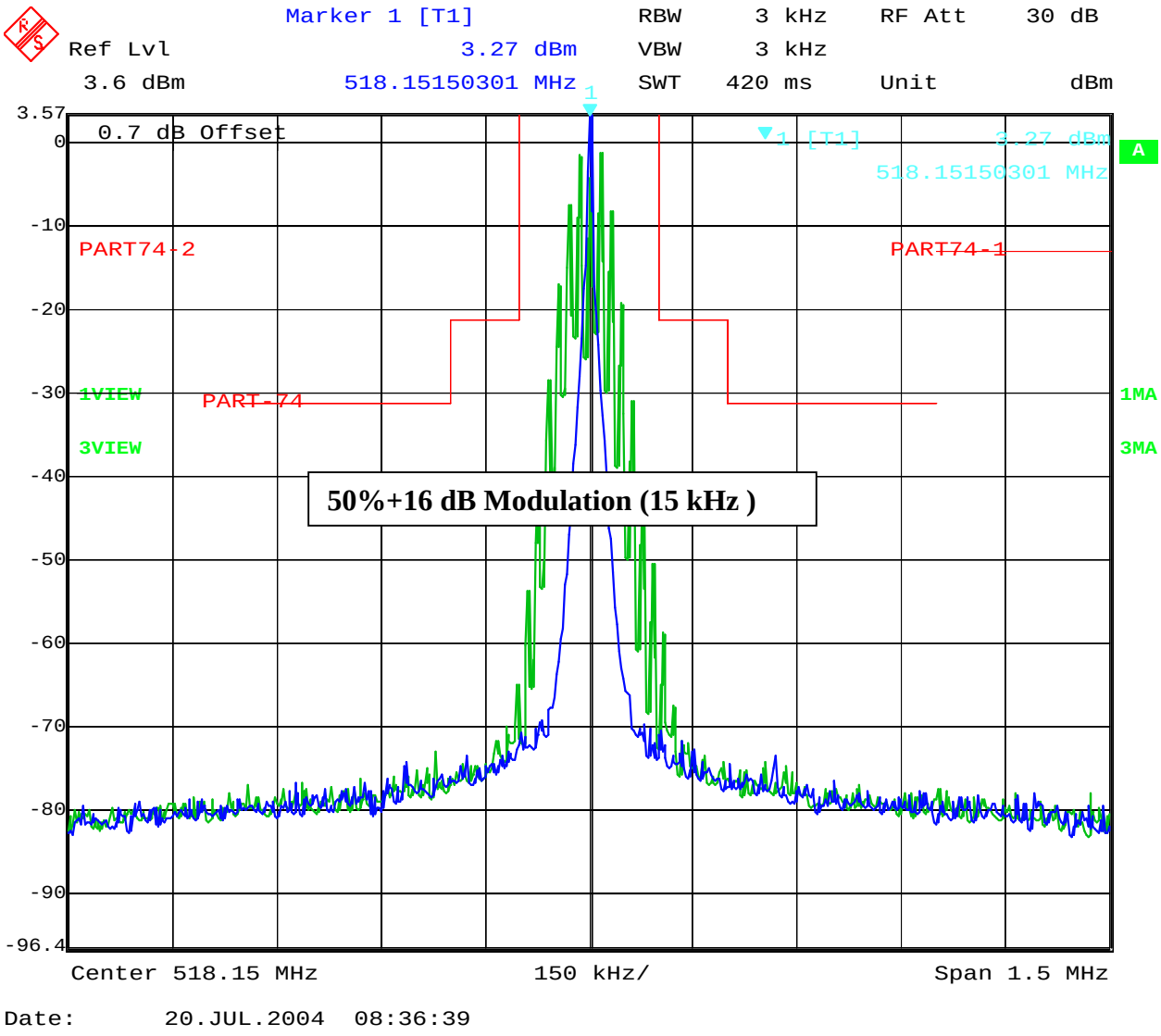


REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64

Equipment under test : SK 2015
Ambient temperature : 25.6°C
Relative humidity : 59%

Emission mask FCC 74 861(e)(6)

518.150 MHz



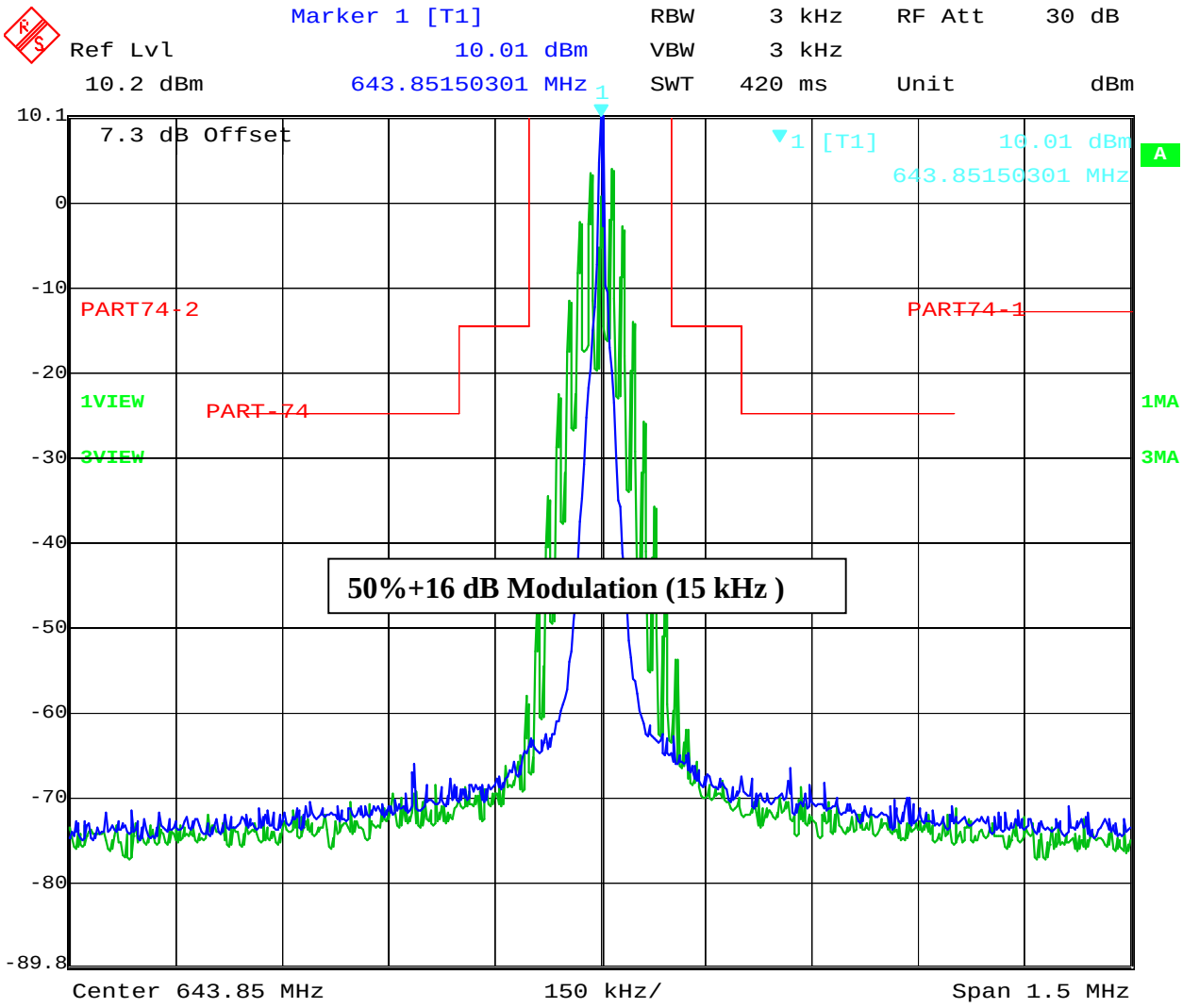
Limits **FCC Rule Part 74.861(e)(6)**

f ± 100 kHz to f ± 200 kHz	f ± 200 kHz to f ± 500 kHz	f ± 500 kHz
25 dBc	35 dBc	-43 +10 $\log_{10}$(mean output power in watts) dB below the mean output power

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64

Equipment under test : SK 2015
Ambient temperature : 25.6°C
Relative humidity : 59%

Emission mask **FCC 74 861(e)(6)**
643.850 MHz



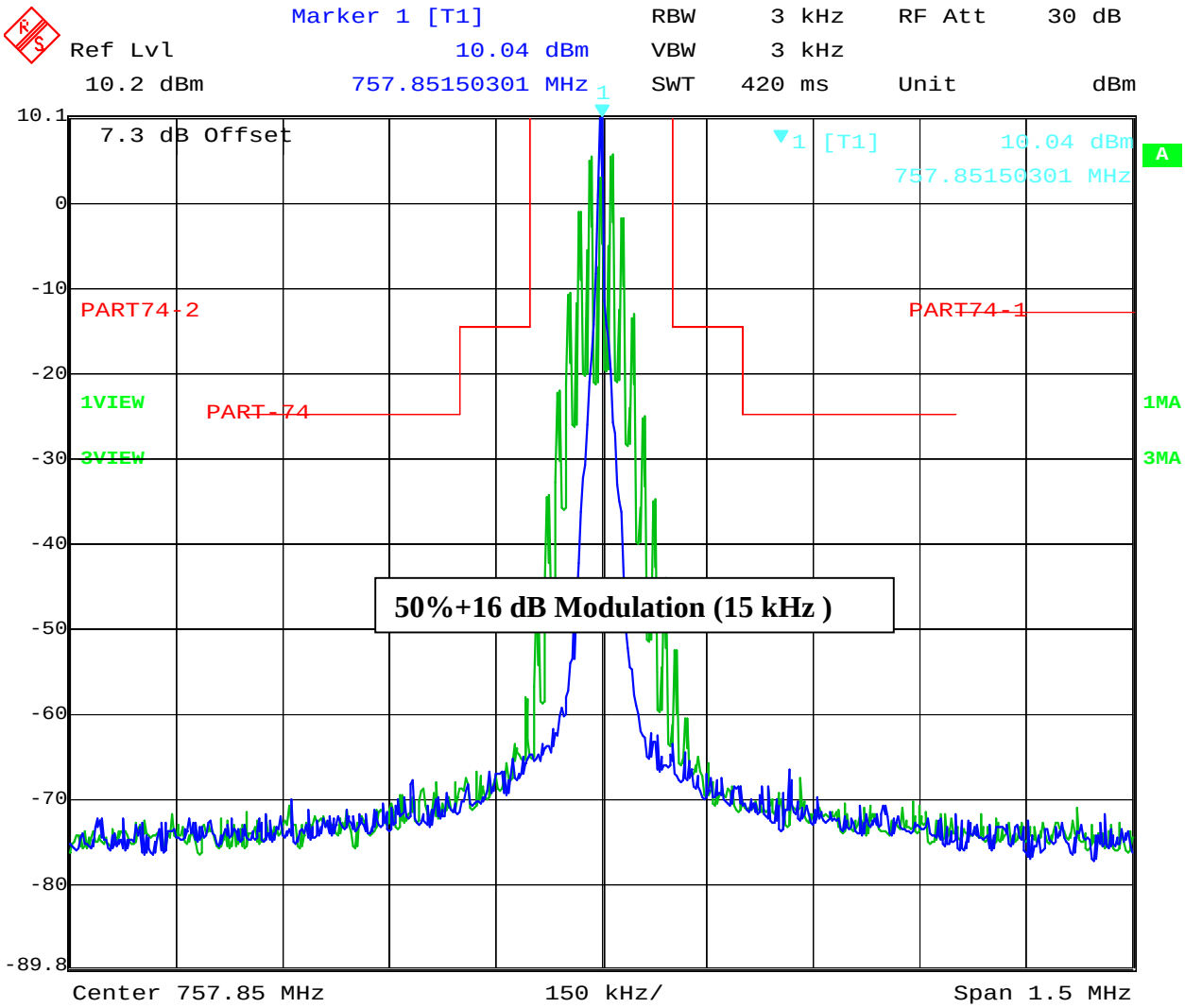
Limits **FCC Rule Part 74.861(e)(6)**

f ± 100 kHz to f ± 200 kHz	f ± 200 kHz to f ± 500 kHz	f ± 500 kHz
25 dBc	35 dBc	-43 +10 $\log_{10}$(mean output power in watts) dB below the mean output power

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64

Equipment under test : SK 2015
Ambient temperature : 25.6°C
Relative humidity : 59%

Emission mask **FCC 74 861(e)(6)**
757.850 MHz



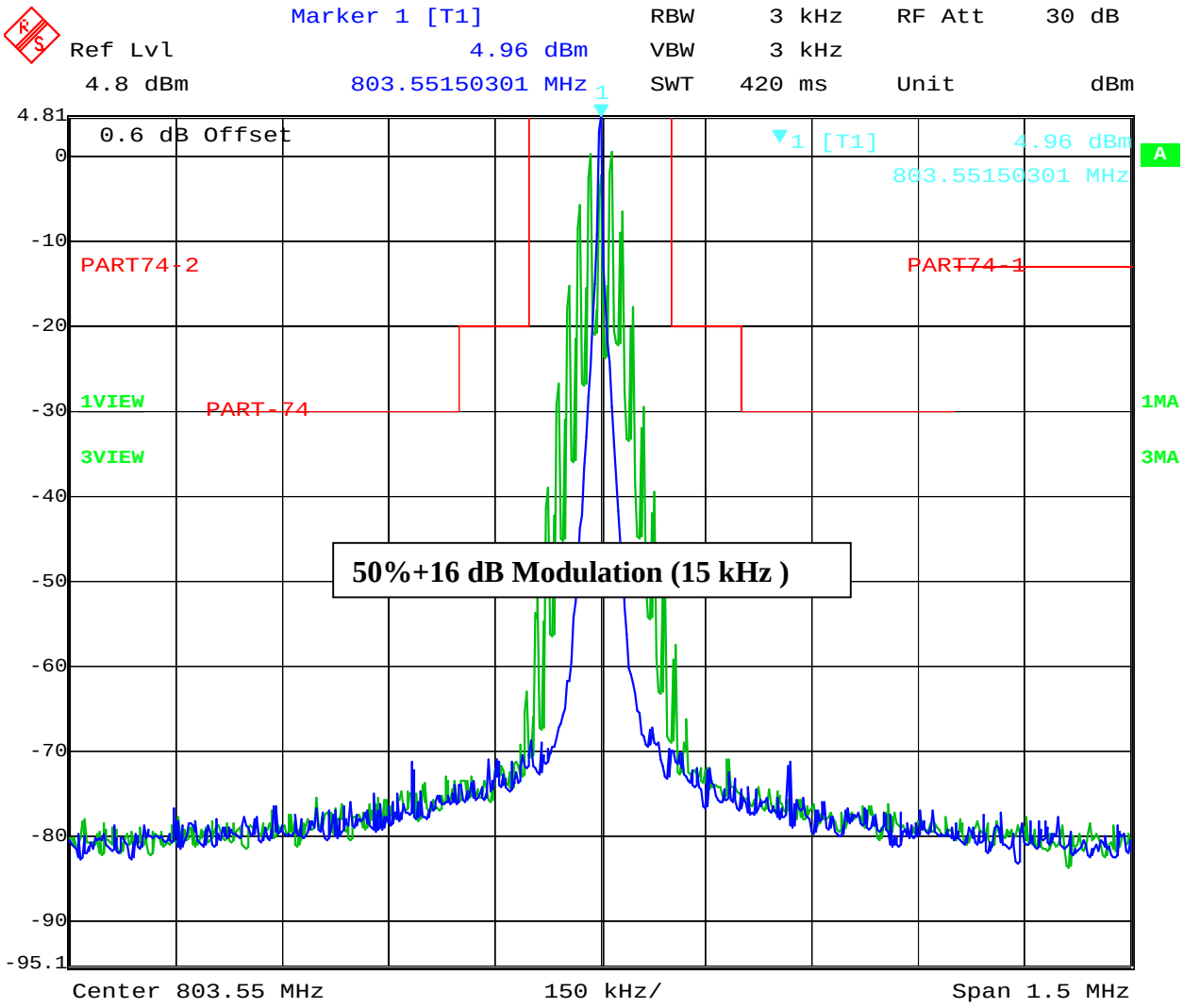
Limits **FCC Rule Part 74.861(e)(6)**

f ± 100 kHz to f ± 200 kHz	f ± 200 kHz to f ± 500 kHz	f ± 500 kHz
25 dBc	35 dBc	-43 +10 $\log_{10}$(mean output power in watts) dB below the mean output power

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64

Equipment under test : SK 2015
Ambient temperature : 25.6°C
Relative humidity : 59%

Emission mask **FCC 74 861(e)(6)**
803.550 MHz



Date: 20.JUL.2004 09:43:08

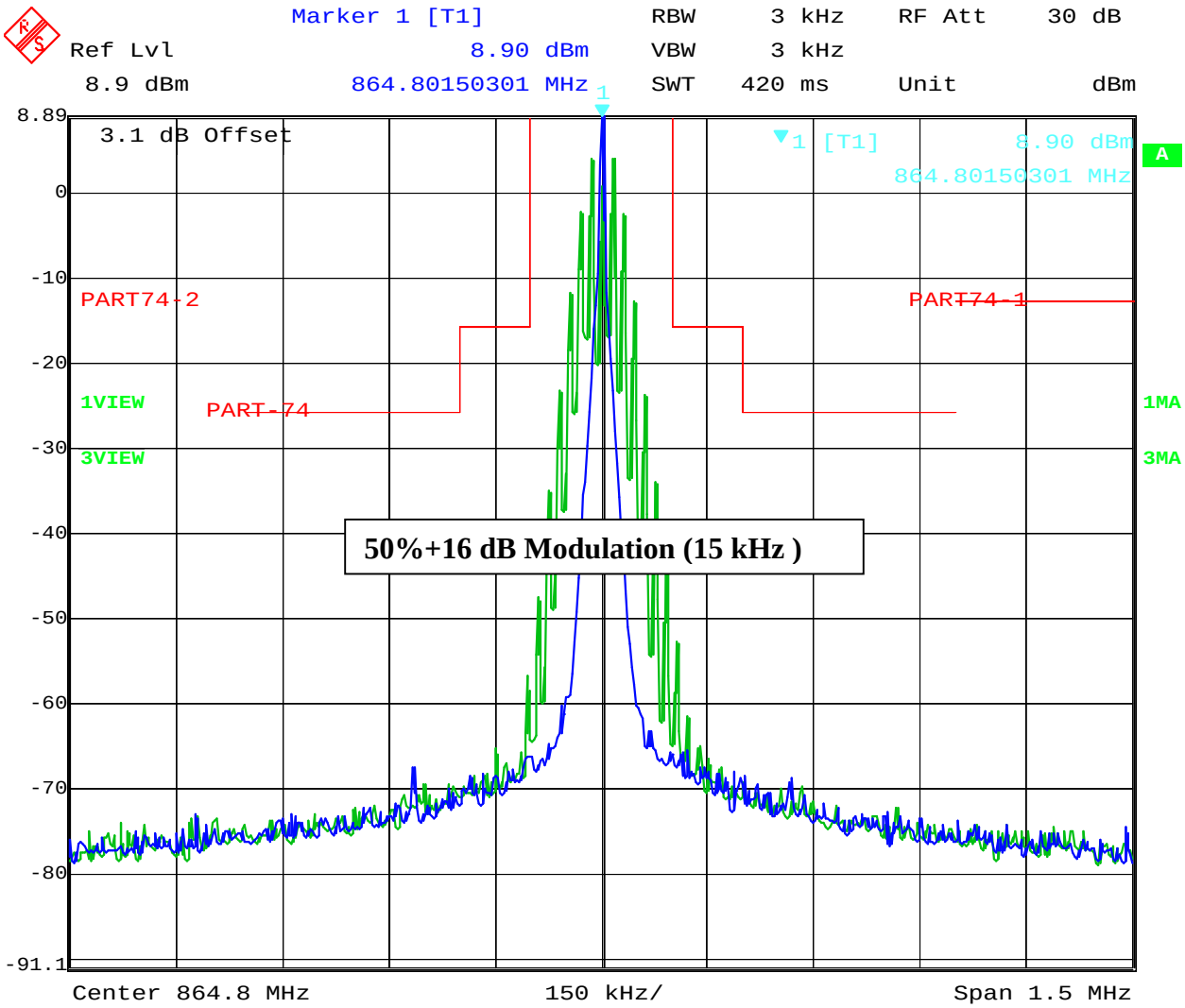
Limits **FCC Rule Part 74.861(e)(6)**

f ± 100 kHz to f ± 200 kHz	f ± 200 kHz to f ± 500 kHz	f ± 500 kHz
25 dBc	35 dBc	-43 +10 $\log_{10}$(mean output power in watts) dB below the mean output power

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64

Equipment under test : SK 2015
Ambient temperature : 25.6°C
Relative humidity : 59%

Emission mask **FCC 74 861(e)(6)**
864.800 MHz



Limits **FCC Rule Part 74.861(e)(6)**

f ± 100 kHz to f ± 200 kHz	f ± 200 kHz to f ± 500 kHz	f ± 500 kHz
25 dBc	35 dBc	-43 +10 $\log_{10}$(mean output power in watts) dB below the mean output power

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
64

Equipment under test : SK 2015
Ambient temperature : 25.6°C
Relative humidity : 59%

RADIATED EMISSIONS **FCC Rule Part 74 subpart H**

Test procedure

1). On a test site, the EUT shall be placed on a turntable, and in the position closest to the normal use as declared by the user.
2). The test antenna shall be oriented initially for vertical polarization located 3m from the EUT to correspond to the frequency of the transmitter.
3). The output of the test antenna shall be connected to the measuring receiver and either a peak or quasi-peak
detector was used for the measurement as indicated on the report. The detector selection is based on how close the emission level was approaching the limit.
4). The transmitter shall be switched on, if possible, without the modulation and the measurement receiver shall be tuned to the frequency of the transmitter under test.
5). The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
6). The transmitter shall than be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
7). The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
8). The maximum signal level detected by the measuring receiver shall be noted.
9). The transmitter shall be replaced by a substitution antenna (tuned dipole for f less than 1GHz and horn for frequency higher than 1GHz).
10). The substitution antenna shall be oriented for vertical polarization and the length (if a dipole antenna is used) of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
11). The substitution antenna shall be connected to a calibrated signal generator.
12). If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
13). The test antenna shall be raised and lowered through the specified range of the height to ensure that the maximum signal is received.
14). The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuation setting of the measuring receiver.
15). The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
16). The measurement shall be repeated with the test antenna and the substitution antenna oriented for horizontal polarization.
17). The measure of the effective radiated power is the larger of the two levels recorded, at the input to the substitution antenna, corrected for the gain of the substitution antenna if necessary.
18). Repeat above substitution measurement procedure for fundamental and all harmonica emissions.

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 - 24

Equipment under test : SK 2015
Ambient temperature : 25.6°C
Relative humidity : 59%

Freg	SA Reading	SG Setting	Ant. gain	Dipole gain	Cable loss	ERP Result	Limit	Margin to limit	Pol
MHz	dBµV	dBm	dBi	dBd	dB	dBm	dBm	dBm	H/V
518.15	72.2	6.3		0.0	2.7	3.6			V
518.15	70.7	4.5		0.0	2.7	1.8			H
1036.3	18.8	-52.05	6.1	2.15	3.1	-51.2	-13	38.3	V
2. to 10. harmonics no traceable peak found									
643.85	79.5	12.8		0.0	2.8	10.0			V
643.85	77.2	10.6		0.0	2.8	7.8			H
1287.7	25.8	-45.25	7.0	2.15	3.2	-43.6	-13	30.6	V
2. to 10. harmonics no traceable peak found									
757.85	78.4	12.9		0.0	2.9	10.0			V
757.85	76.1	10.0		0.0	2.9	7.1			H
1515.7	36.5	-57.95	8.4	2.15	3.3	-55.0	-13	42.0	V
2. to 10. harmonics no traceable peak found									

Freg	SA Reading	SG Setting	Ant. gain	Dipole gain	Cable loss	ERP Result	Limit	Margin Limit	Pol
MHz	dBµV	dBm	dBi	dBd	dB	dBm	dBm	dB	H/V
803.55	72.6	8.3		0.0	3.1	5.1			V
803.55	70.1	5.3		0.0	3.1	2.8			H
1607.1	45.7	-42.35	8.4	2.15	3.4	-39.5	-13	26.5	
2. to 10. harmonics no traceable peak found									
864.80	76.3	12.1		0.0	3.2	8.9			V
864.80	74.6	9.2		0.0	3.2	6.0			H
1729.6	49.1	-42.75	8.4	2.15	3.4	-39.9	-13	26.9	V
2. to 10. harmonics no traceable peak found									

all results worst case

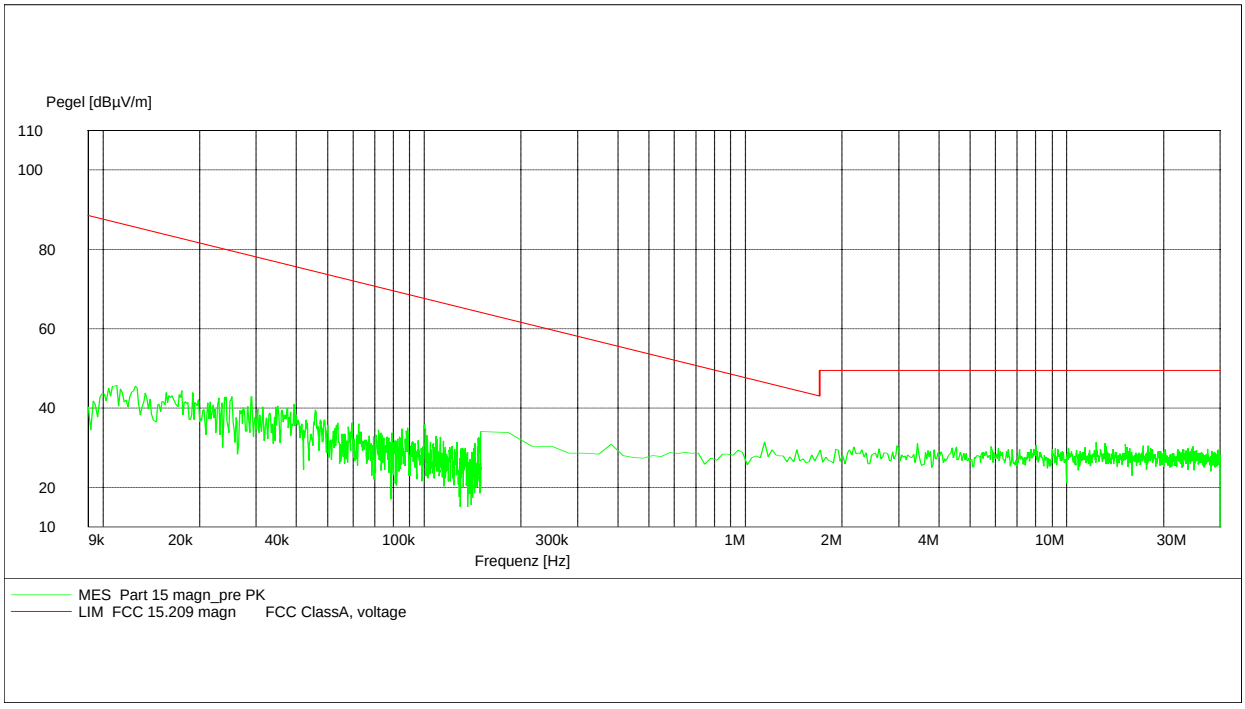
Limits **FCC Rule Part 74.861(e)(6)**

f ± 100 kHz to f ± 200 kHz	f ± 200 kHz to f ± 500 kHz	f ± 500 kHz
25 dBc	35 dBc	-43 +10 $\log_{10}$(mean output power in watts) dB below the mean output power

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 - 24

Equipment under test : SK 2015
Ambient temperature : 25.6°C
Relative humidity : 59%
RADIATED EMISSIONS **FCC Rule Part 74 subpart H**
(this plot is valid for all channels)
Part 15.209 Magnetics

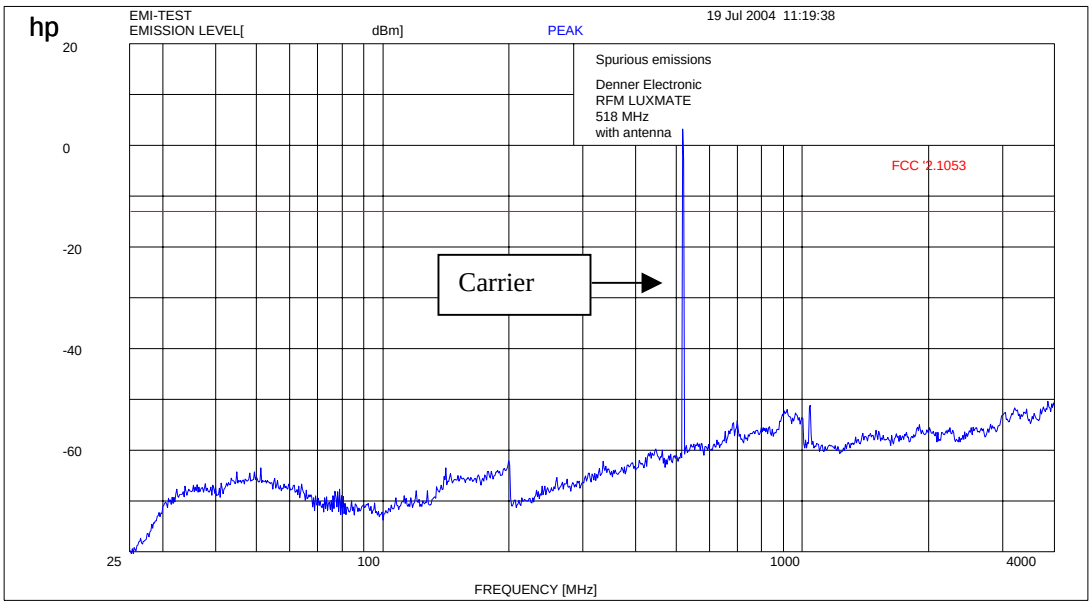
```
EUT:                  SK 2015
Manufacturer:         Sennheiser electronic GmbH & Co.KG
Operating Condition:  Transmit mode
Test Site:            Cetecom, Room 6
Operator:             Berg
Test Specification:   3.0 V (Battery)
Comment:
Start of Test:        20.07.04 / 14:56:48
```

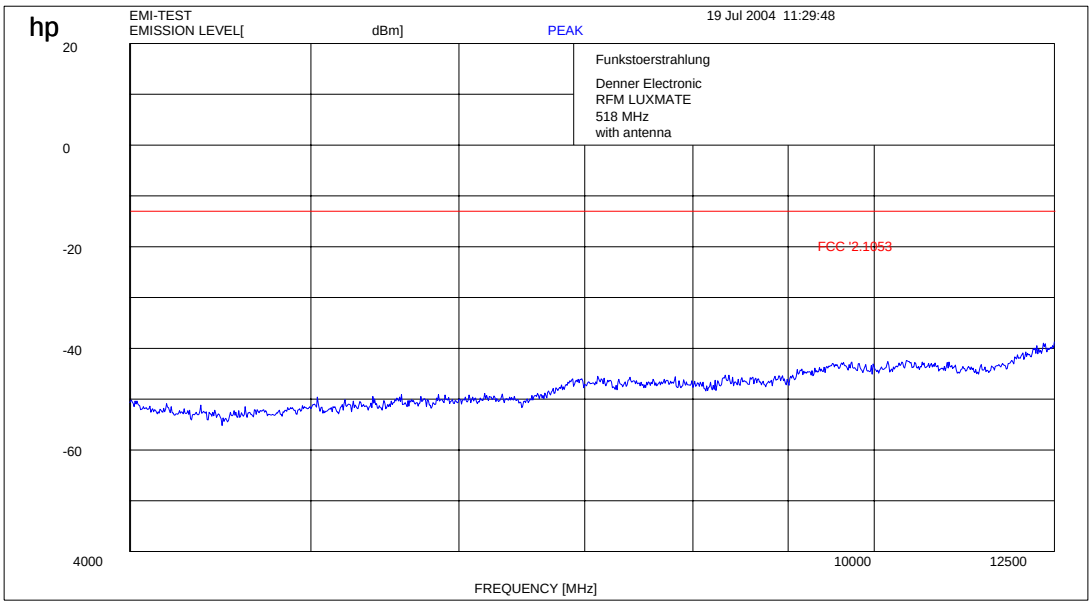


REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 - 24

Equipment under test : SK 2015
Ambient temperature : 25.6°C
Relative humidity : 59%

RADIATED EMISSIONS **FCC Rule Part 74 subpart H**
518.150 MHz

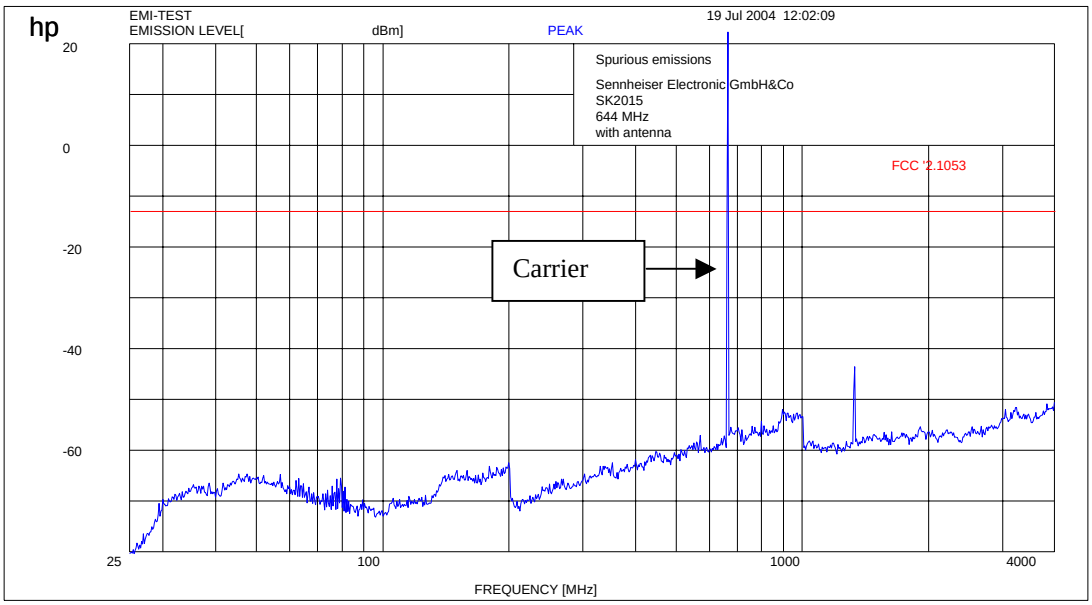


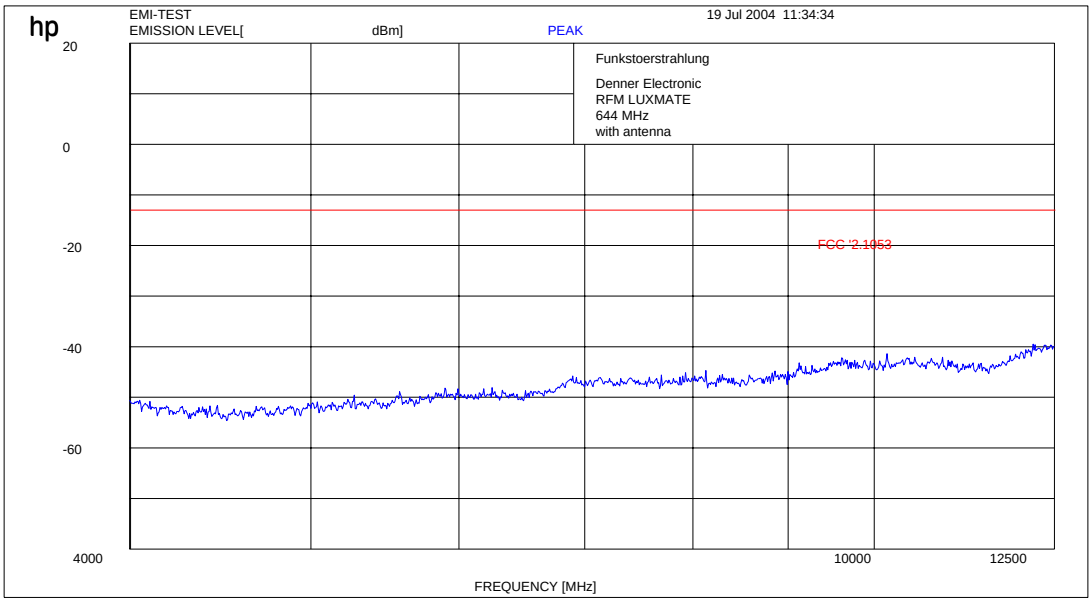


REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 - 24

Equipment under test : SK 2015
Ambient temperature : 25.6°C
Relative humidity : 59%

RADIATED EMISSIONS **FCC Rule Part 74 subpart H**
643.850 MHz

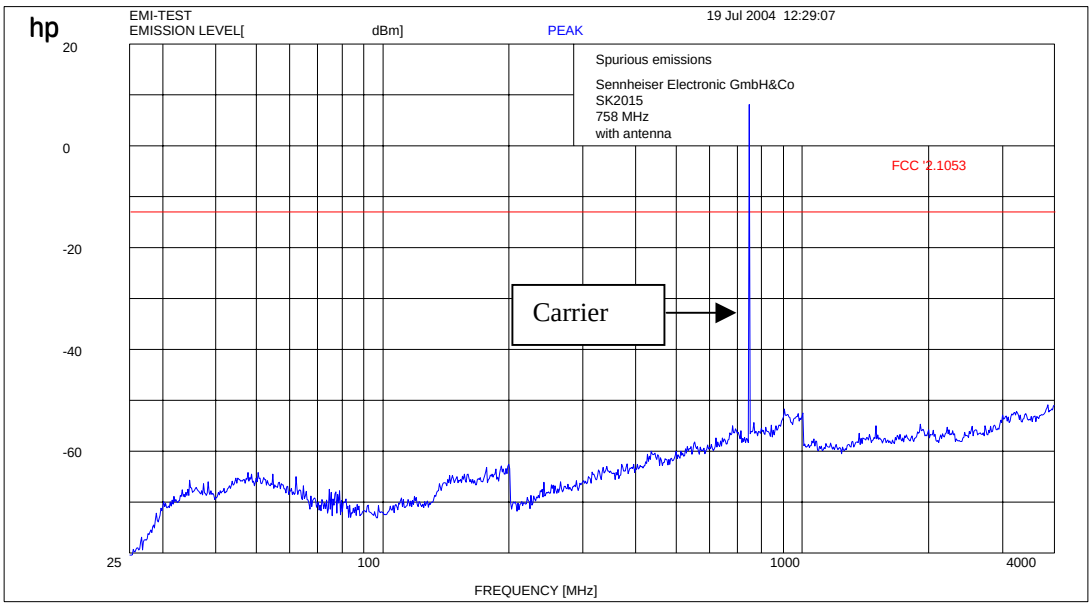


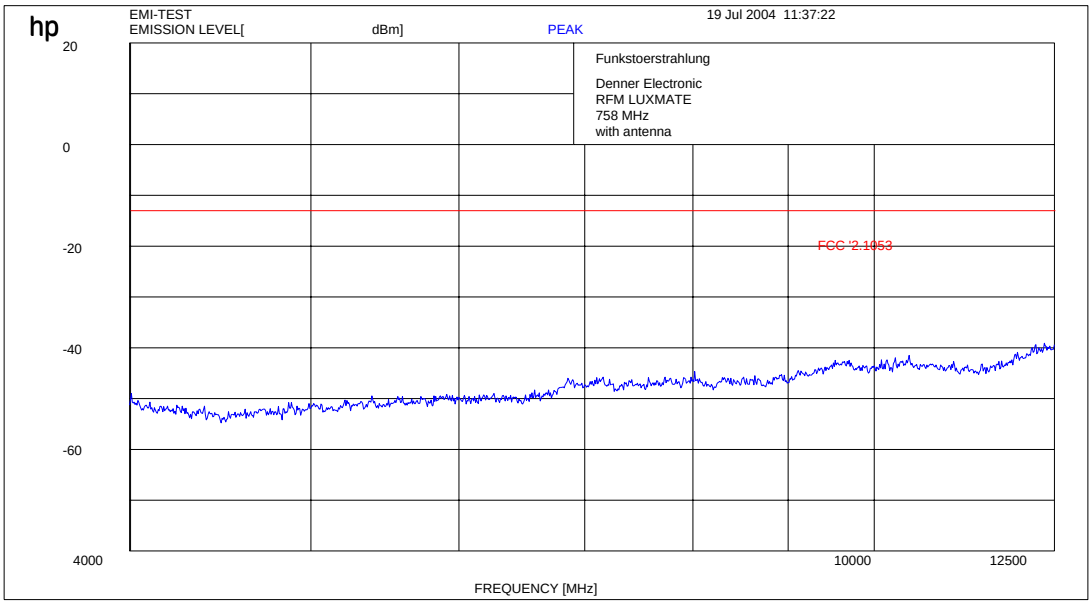


REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 - 24

Equipment under test : SK 2015
Ambient temperature : 25.6°C
Relative humidity : 59%

RADIATED EMISSIONS **FCC Rule Part 74 subpart H**
75.850 MHz

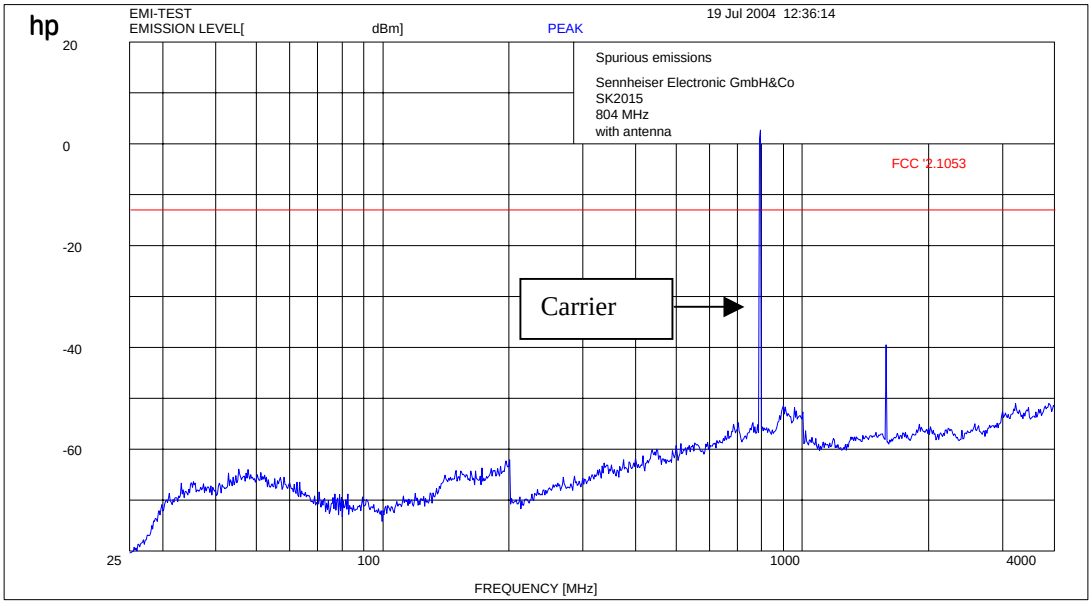


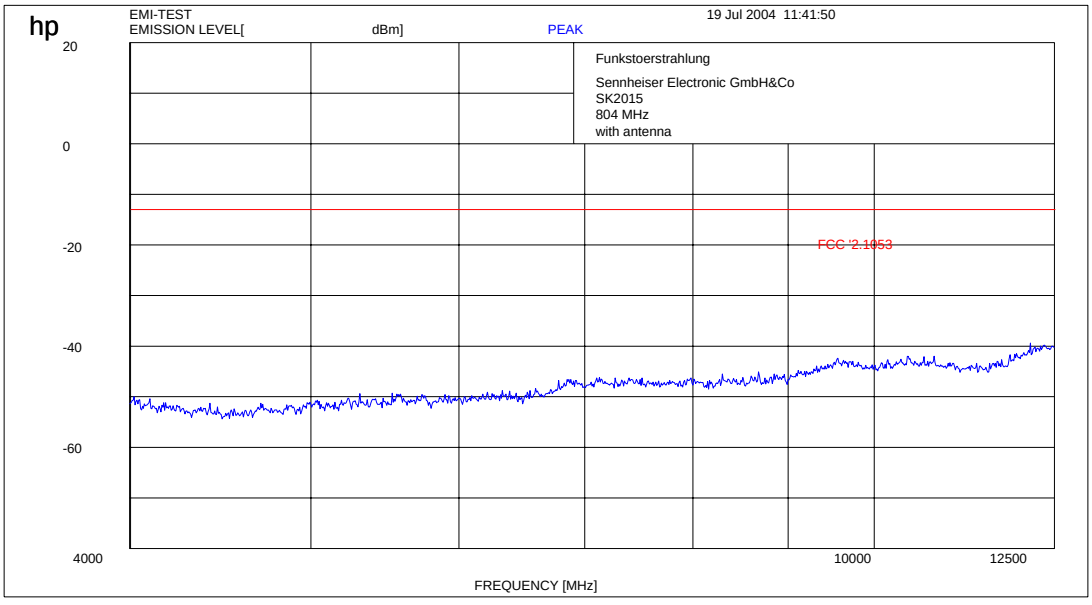


REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 - 24

Equipment under test : SK 2015
Ambient temperature : 25.6°C
Relative humidity : 59%

RADIATED EMISSIONS **FCC Rule Part 74 subpart H**
803.550 MHz

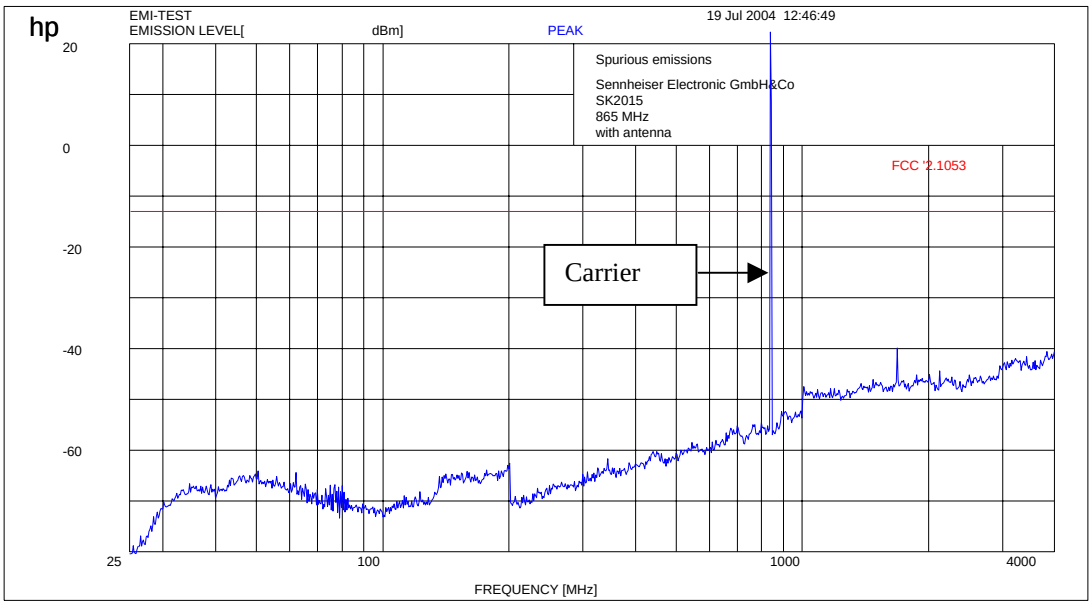


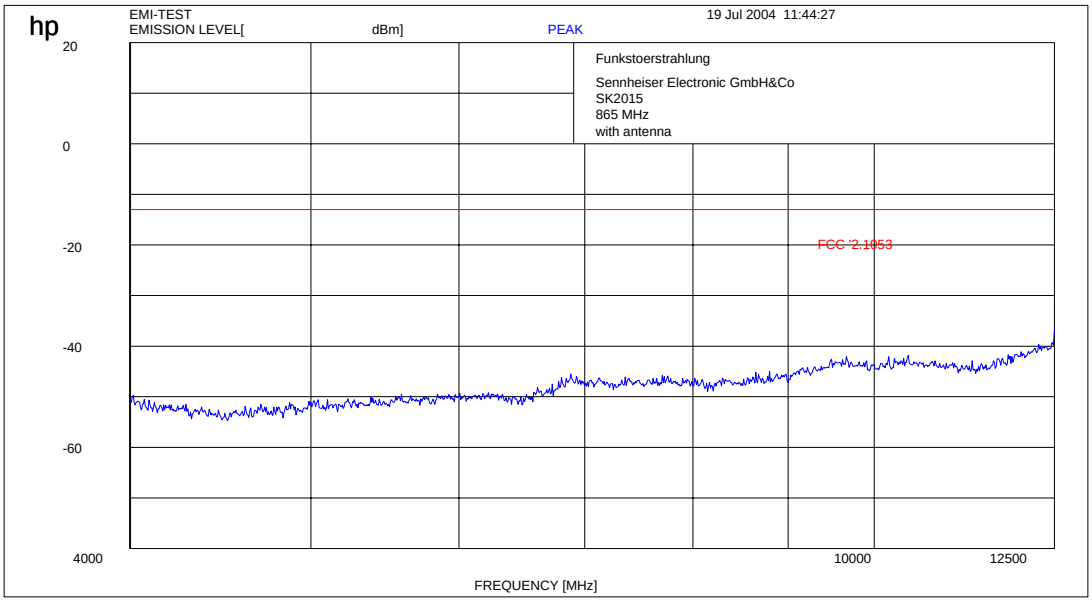


REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 - 24

Equipment under test : SK 2015
Ambient temperature : 25.6°C
Relative humidity : 59%

RADIATED EMISSIONS **FCC Rule Part 74 subpart H**
864.800 MHz





REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 - 24

Equipment under test : EK 2015
Ambient temperature : 24.3°C
Relative humidity : 56%

FCC Part 15 Subpart B

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 20 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber.
The receiving antennas are conform with specifications ANSI C63.2-1996 clause 15 and ANSI C63.4-2001 clause 4.1.5. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test set-ups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received.
The wanted and unwanted emissions are received by spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.4-2001 clause 4.2.
Antennas are conform with ANSI C63.2-1996 item 15.
150 kHz - 30 MHz: Quasi Peak measurement, 9kHz Bandwidth, passive loop antenna.

30 MHz - 200 MHz: Quasi Peak measurement, 120KHz Bandwidth, biconical antenna
200MHz - 1GHz: Quasi Peak measurement, 120KHz Bandwidth, log periodic antenna
>1GHz: Average, RBW 1MHz, VBW 10 Hz, wave guide horn

All measurement settings are according to FCC 15.35, 15.209.

The product fulfils also the requirements for CANADA RSS-210

No deviations from the technical specification(s) were ascertained in the course of the tests performed.

FINAL VERDICT : PASS

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 - 24

Equipment under test : EK 2015
Ambient temperature : 24.3°C
Relative humidity : 56%

SPURIOUS RADIATION § 15.109
Radiated

SPURIOUS EMISSIONS LEVEL (µV/m)								
518.000 MHz			644.000 MHz			758.000 MHz		
f (MHz)	Detector	Level (dBµV/m)	f (MHz)	Detector	Level (dBµV/m)	f (MHz)	Detector	Level (dBµV/m)
no traceable peak found								
804.000 MHz			865.000 MHz					
no traceable peak found								
Measurement uncertainty			±3 dB					

f < 1 GHz : RBW/VBW: 100 kHz **f ≥ 1GHz : RBW/VBW: 1 MHz**
H = Horizontal ; V= Vertical

Measurement distance see table

Limits **SUBCLAUSE § 15.109**

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30 / 29.5 dBµV/m	30
30 - 88	100 / 40 dBµV/m	3
88 - 216	150 / 43.5 dBµV/m	3
216 - 960	200 / 46 dBµV/m	3
above 960	500 / 54 dBµV/m	3

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 - 24

Equipment under test : EK 2015
Ambient temperature : 24.3°C
Relative humidity : 56%

RADIATED EMISSIONS § 15.109
(this plot is valid for all channels)

FCC Rule 47

```
EUT:                  EK 2015
Manufacturer:         Sennheiser electronic  GmbH & Co.KG
Operating Condition:  Receiver
Test Site:            Cetecom, Room 6
Operator:             Berg
Test Specification:   115v / 60 Hz
Comment:
Start of Test:        20.07.04 / 15:06:46
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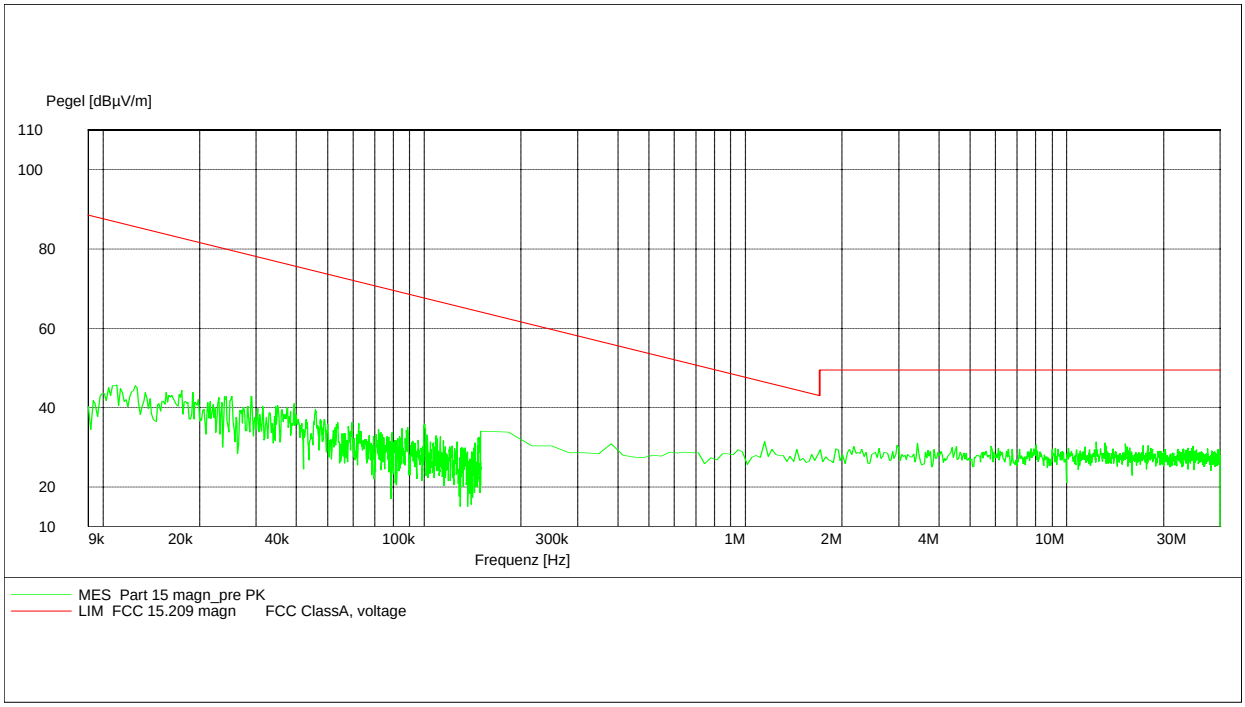
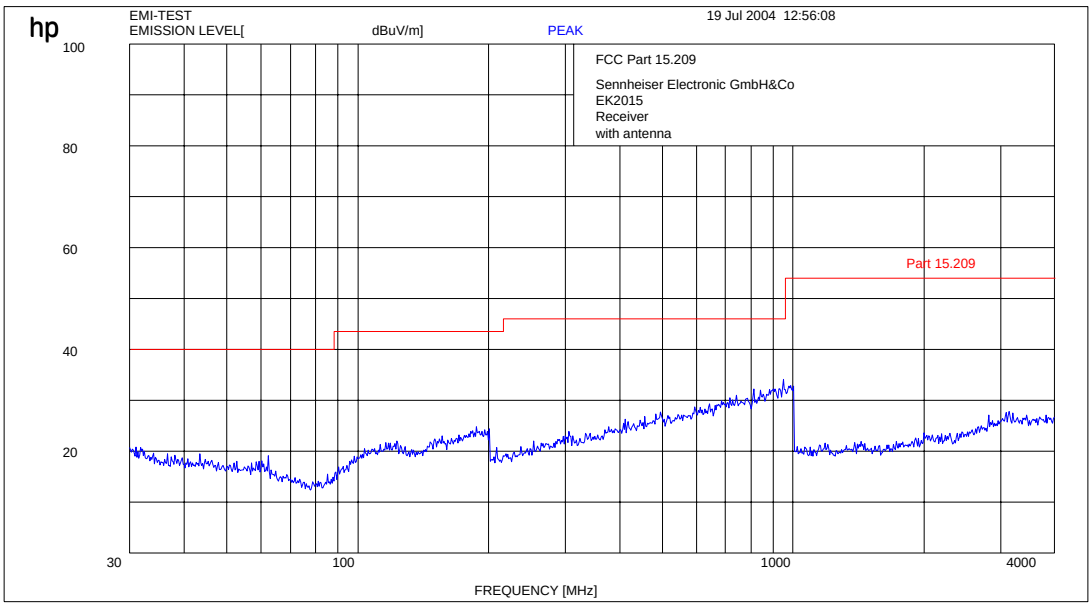
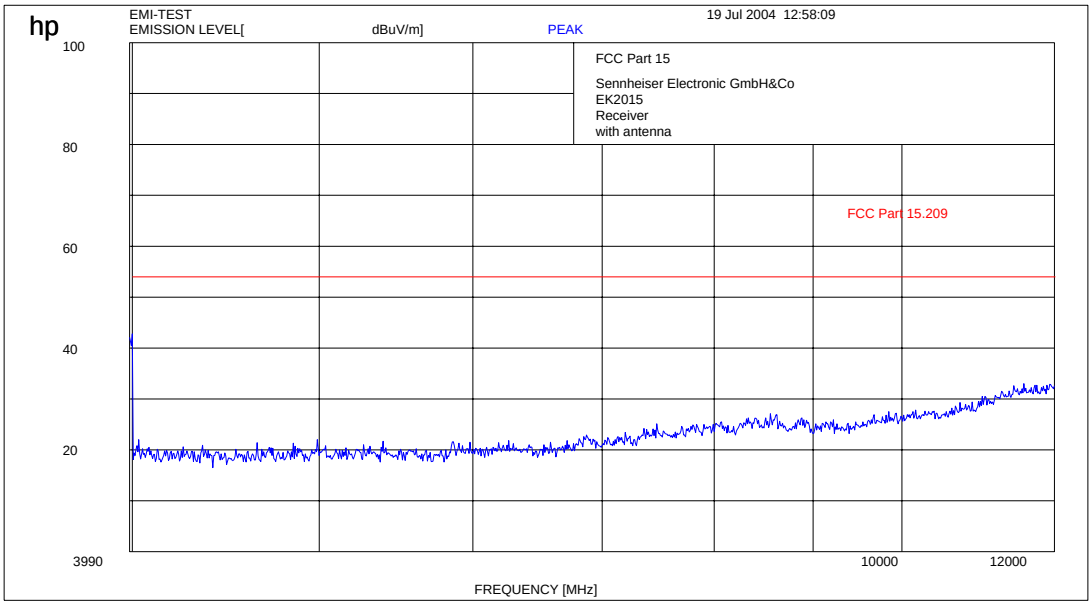


REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 - 24

Equipment under test : EK 2015
Ambient temperature : 24.3°C
Relative humidity : 56%

RADIATED EMISSIONS § 15.109





REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)
17 - 24

TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

To simplify the identification on each page of the test equipment used, on each page of the test report, each item of test equipment and ancillaries such as cables are identified (numbered) by the Test Laboratory, below.

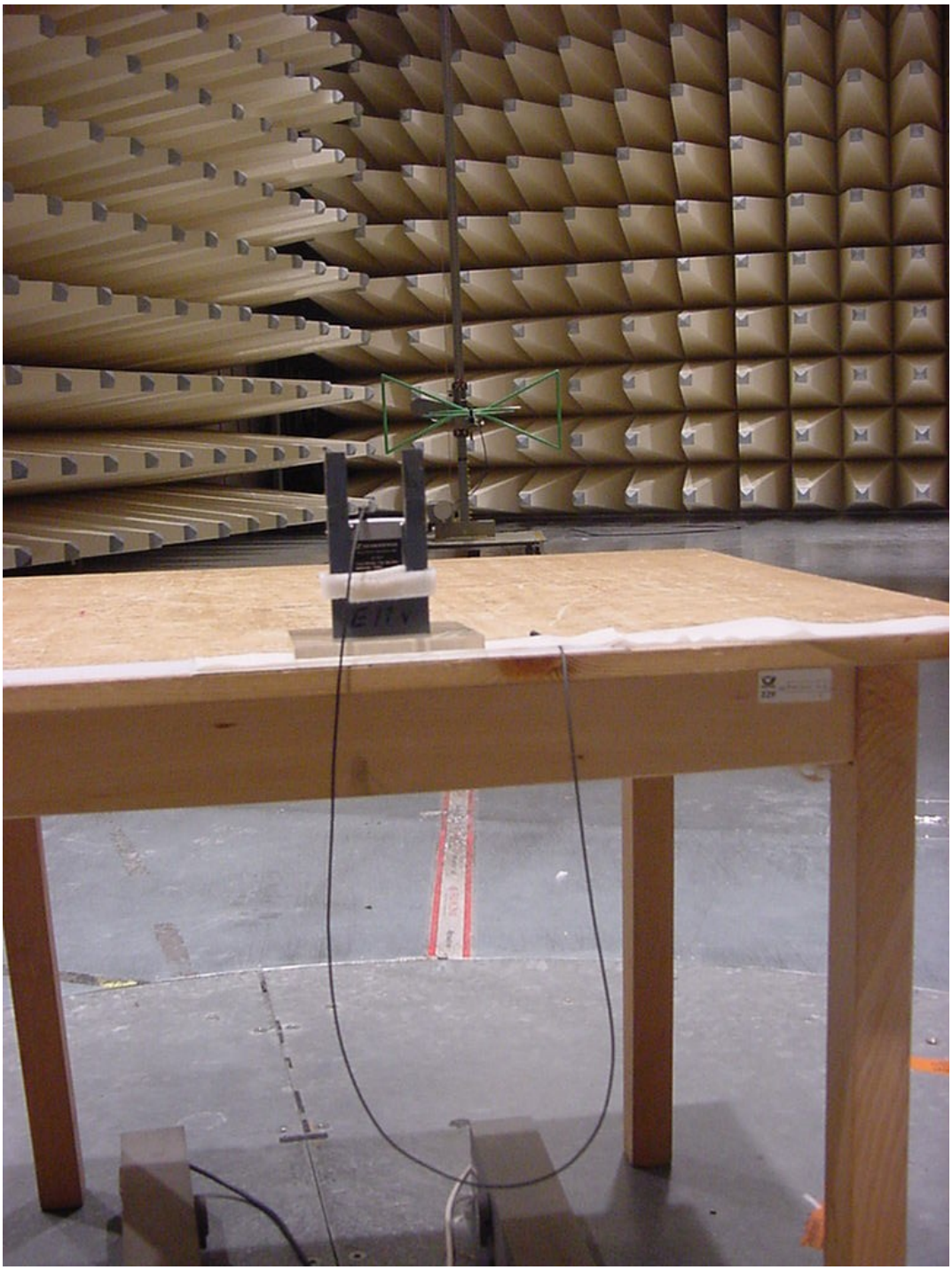
No	Instrument/Ancillary	Type	Manufacturer	Serial No.	Calibrated
01	Spectrum Analyzer	8566 A	Hewlett-Packard	1925A00257	Yes
02	Analyzer Display	8566 A	Hewlett-Packard	1925A00860	Yes
03	Oscilloscope	7633	Tektronix	230054	Yes
04	Radio Communication Analyzer	CMTA 54	Rohde & Schwarz	894 043/010	Yes
05	System Power Supply	6038 A	Hewlett-Packard	2848A07027	Yes
06	Signal Generator	8111 A	Hewlett-Packard	2215G00867	Yes
07	Signal Generator	8662 A	Hewlett-Packard	2224A01012	Yes
08	Function Generator	AFGU	Rohde & Schwarz	862 480/032	Yes
09	Regulating Transformer	MPL	Erfi	91350	n.a.
10	LISN	NNLA 8120	Schwarzbeck	8120331	Yes
11	Relay-Matrix	PSU	Rohde & Schwarz	893 285/020	Yes
12	Power-Meter	436 A	Hewlett-Packard	2101A12378	Yes
13	Power-Sensor	8484 A	Hewlett-Packard	2237A10156	Yes
14	Power-Sensor	8482 A	Hewlett-Packard	2237A00616	Yes
15	Modulation Meter	9008	Racal-Dana	2647	Yes
16	Frequency Counter	5340 A	Hewlett-Packard	1532A03899	Yes
17	Anechoic Chamber	---	MWB	87400/002	Yes
18	Spectrum Analyzer	85660 B	Hewlett-Packard	2747A05306	Yes
19	Analyzer Display	85662 A	Hewlett-Packard	2816A16541	Yes
20	Quasi Peak Adapter	85650 A	Hewlett-Packard	2811A01131	Yes
21	RF-Preselector	85685 A	Hewlett-Packard	2833A00768	Yes
22	Biconical Antenna	3104	Emco	3758	Yes
23	Log. Per. Antenna	3146	Emco	2130	Yes
24	Double Ridged Horn	3115	Emco	3088	Yes
25	EMI-Testreceiver	ESAI	Rohde & Schwarz	863 180/013	Yes
26	EMI-Analyzer-Display	ESAI-D	Rohde & Schwarz	862 771/008	Yes
27	Biconical Antenna	HK 116	Rohde & Schwarz	888 945/013	Yes
28	Log. Per. Antenna	HL 223	Rohde & Schwarz	825 584/002	Yes
29	Relay-Switch-Unit	RSU	Rohde & Schwarz	375 339/002	Yes
30	Highpass	HM985955	FSY Microwave	001	n.a.
31	Amplifier	P42-GA29	Tron-Tech	B 23602	Yes
32	Anechoic Chamber		Frankonia		Yes
33	Control Computer	PSM 7	Rohde & Schwarz	834 621/004	Yes
34	EMI Test Receiver	ESMI	Rohde & Schwarz	827 063/010	Yes
35	EMI Test Receiver	Display	Rohde & Schwarz	829 808/010	Yes

TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

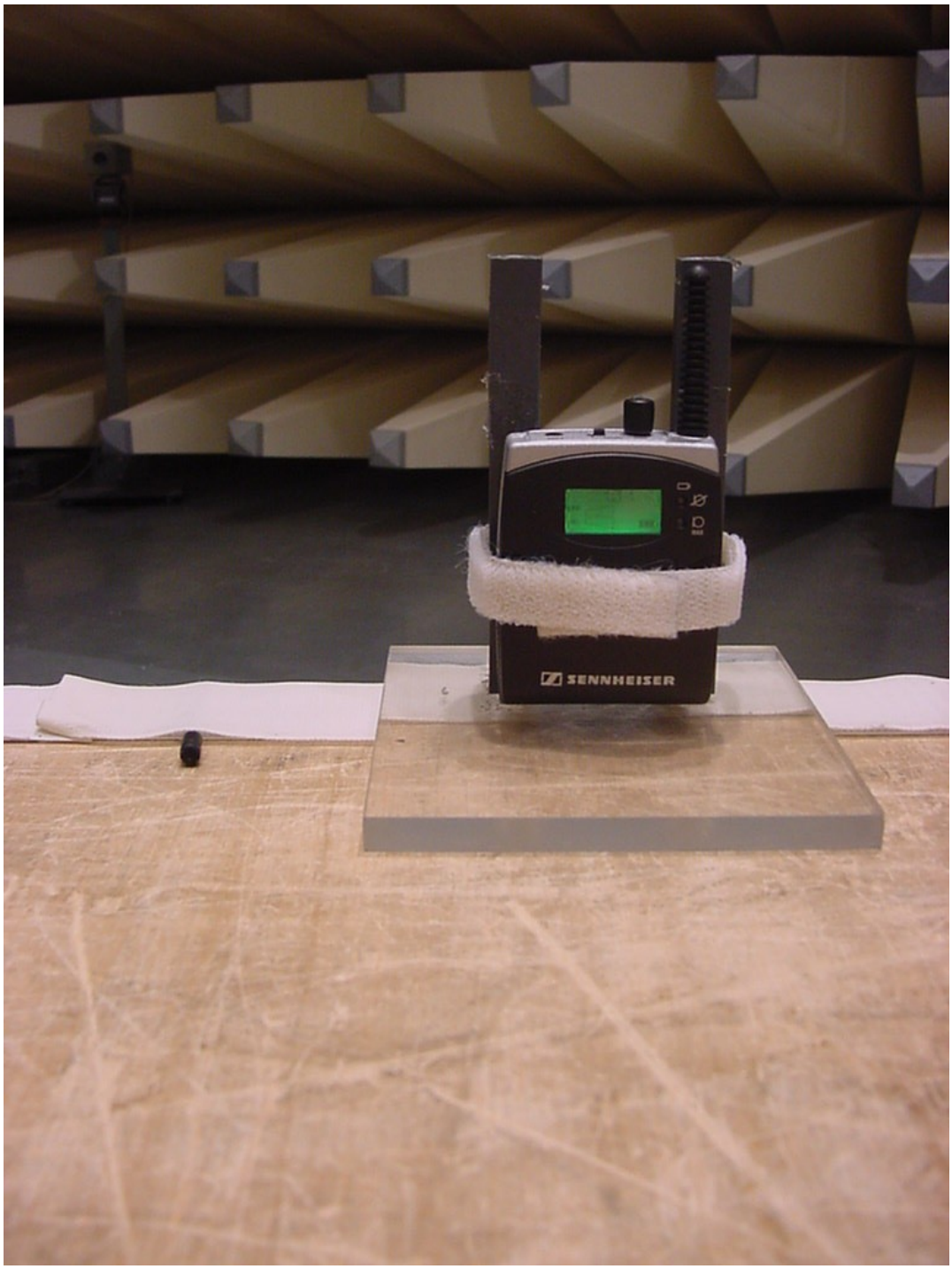
To simplify the identification on each page of the test equipment used, on each page of the test report, each item of test equipment and ancillaries such as cables are identified (numbered) by the Test Laboratory, below.

No	Instrument/Ancillary	Type	Manufacturer	Serial No.	Calibrated
36	Control Computer	HD 100	Deisel	100/322/93	n.a.
37	Relay Matrix	PSN	Rohde & Schwarz	829 065/003	Yes
38	Control Unit	GB 016 A2	Rohde & Schwarz	344 122/008	Yes
39	Relay Switch Unit	RSU	Rohde & Schwarz	316 790/001	Yes
40	Power Supply	6032A	Hewlett Packard	2846A04063	Yes
41	Spectrum Monitor	EZM	Rohde & Schwarz	883 720/006	n.a.
42	Measuring Receiver	ESH 3	Rohde & Schwarz	890 174/002	Yes
43	Measuring Receiver	ESVP	Rohde & Schwarz	891 752/005	Yes
44	Bicon Ant. 20-300MHz	HK 116	Rohde & Schwarz	833 162/011	Yes
45	Logper Ant. 0.3-1 GHz	HL 223	Rohde & Schwarz	832 914/010	Yes
46	Amplifier 0.1-4 GHz	AFS4	Miteq Inc.	206461	Yes
47	Logper Ant. 1-18 GHz	HL 024 A2	Rohde & Schwarz	342 662/002	Yes
48	Polarisation Network	HL 024 Z1	Rohde & Schwarz	341 570/002	Yes
49	Double Ridged Horn Antenna 1-26.5 GHz	3115	EMCO	9107-3696	Yes
50	Microw. Sys. Amplifier 0.5- 26.5 GHz	8317A	Hewlett Packard	3123A00105	Yes
51	Audio Analyzer	UPD	Rohde & Schwarz	1030.7500.04	Yes
52	Controler	PSM 7	Rohde & Schwarz	883 086/026	Yes
53	DC V-Network	ESH3-Z6	Rohde & Schwarz	861 406/005	Yes
54	DC V-Network	ESH3-Z6	Rohde & Schwarz	893 689/012	Yes
55	AC 2 Phase V-Network	ESH3-Z5	Rohde & Schwarz	861 189/014	Yes
56	AC 2 Phase V-Network	ESH3-Z5	Rohde & Schwarz	894 981/019	Yes
57	AC-3 Phase V-Network	ESH2-Z5	Rohde & Schwarz	882 394/007	Yes
58	Power Supply	6032A	Rohde & Schwarz	2933A05441	Yes
59	RF-Test Receiver	ESVP.52	Rohde & Schwarz	881 487/021	Yes
60	Spectrum Monitor	EZM	Rohde & Schwarz	883 086/026	n.a.
61	RF-Test Receiver	ESH3	Rohde & Schwarz	881 515/002	Yes
62	Relay Matrix	PSU	Rohde & Schwarz	882 943/029	Yes
63	Relay Matrix	PSU	Rohde & Schwarz	828 628/007	Yes
64	Spectrum Analyzer	FSIQ 26	Rohde & Schwarz	119.6001.27	Yes
65	Spectrum Analyzer	HP 8565E	Hewlett Packard	3473A00773	Yes
68					

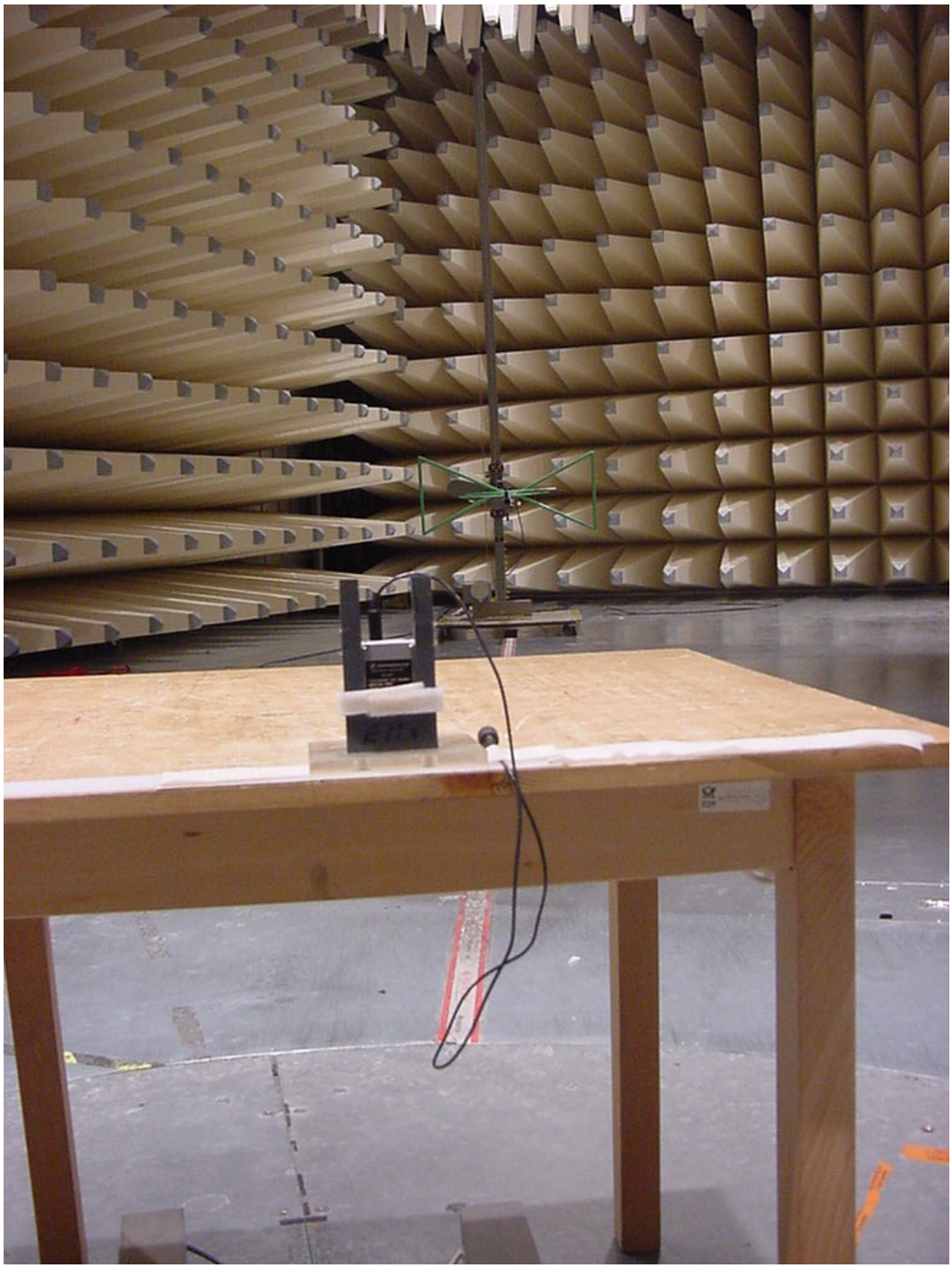
Test setup
Radiated Emissions
SK 2015



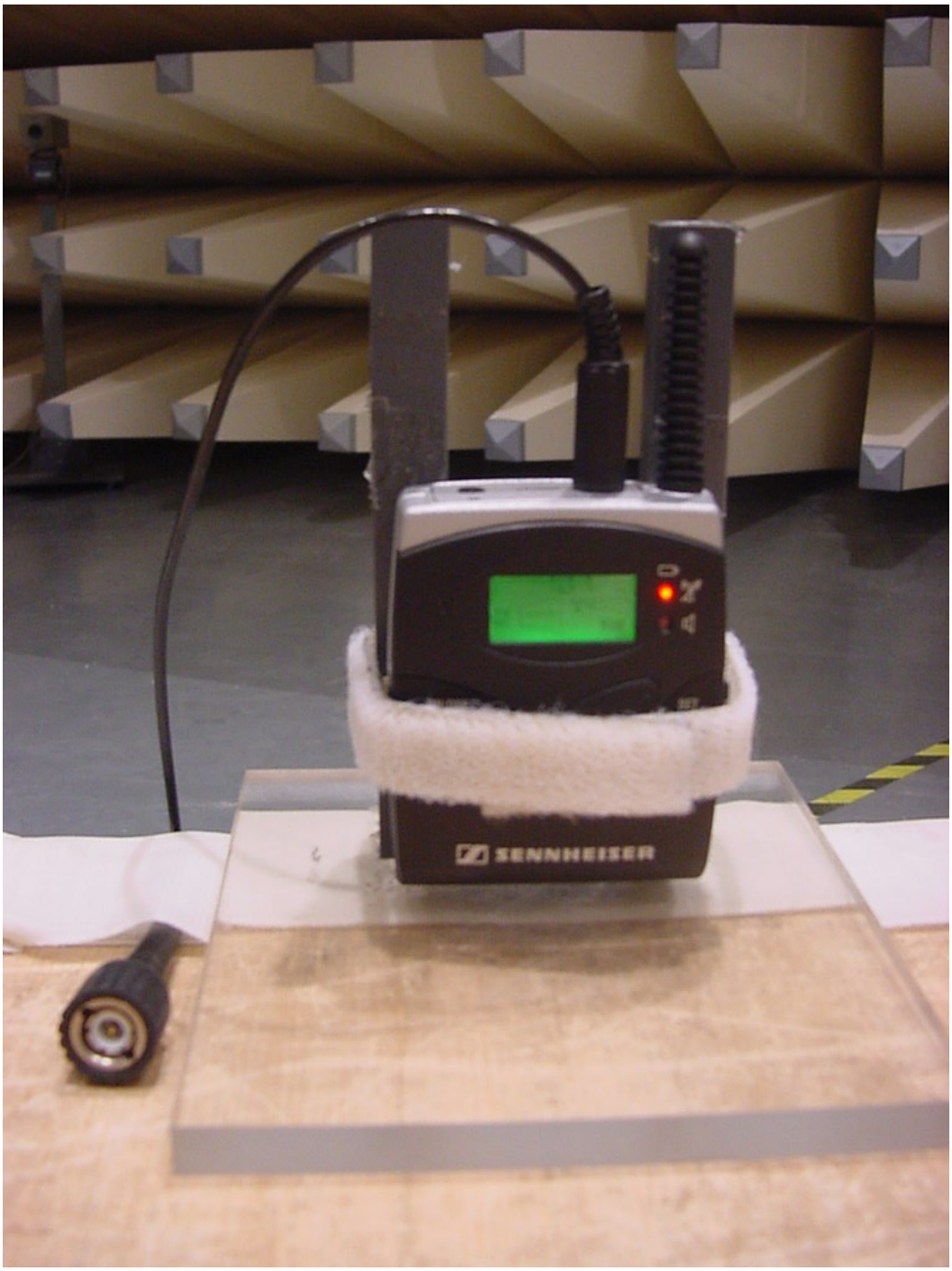
Test setup
Radiated Emissions
SK 2015



Test site
Radiated Emissions
EK 2015



Test site
Radiated Emissions
EK 2015



Photographs of the equipment

SK 2015
Photograph no.: 1

Photographs of the equipment

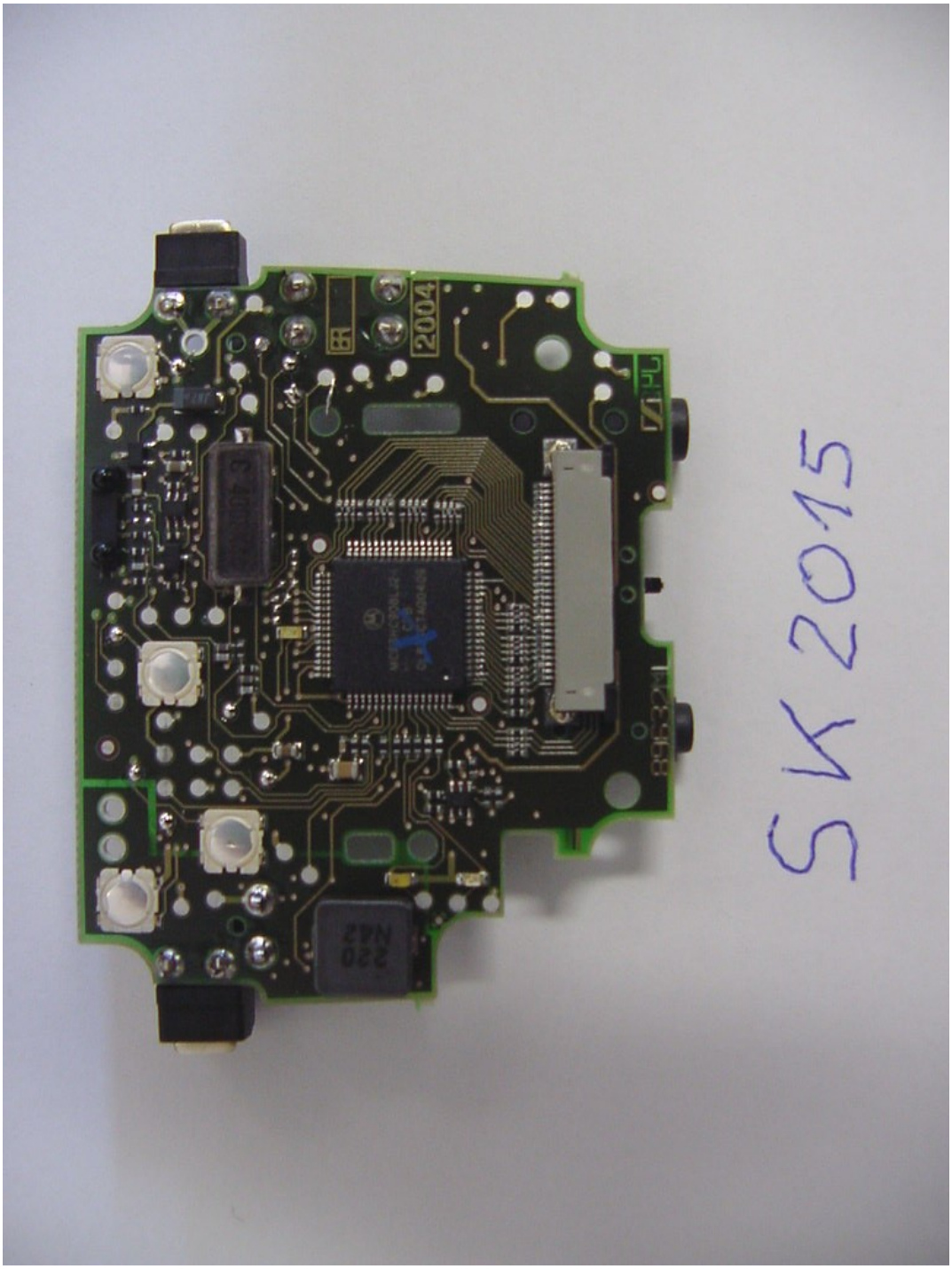
SK 2015
Photograph no.: 2

Photographs of the equipment

SK 2015
Photograph no.: 3

Photographs of the equipment

SK 2015
Photograph no.: 4



Photographs of the equipment

SK 2015 (RF-Board)
Photograph no.: 5

Photographs of the equipment

SK 2015 (RF-Board)
Photograph no.: 6

Photographs of the equipment

EK 2015
Photograph no.: 7

Photographs of the equipment

EK 2015
Photograph no.: 8

Photographs of the equipment

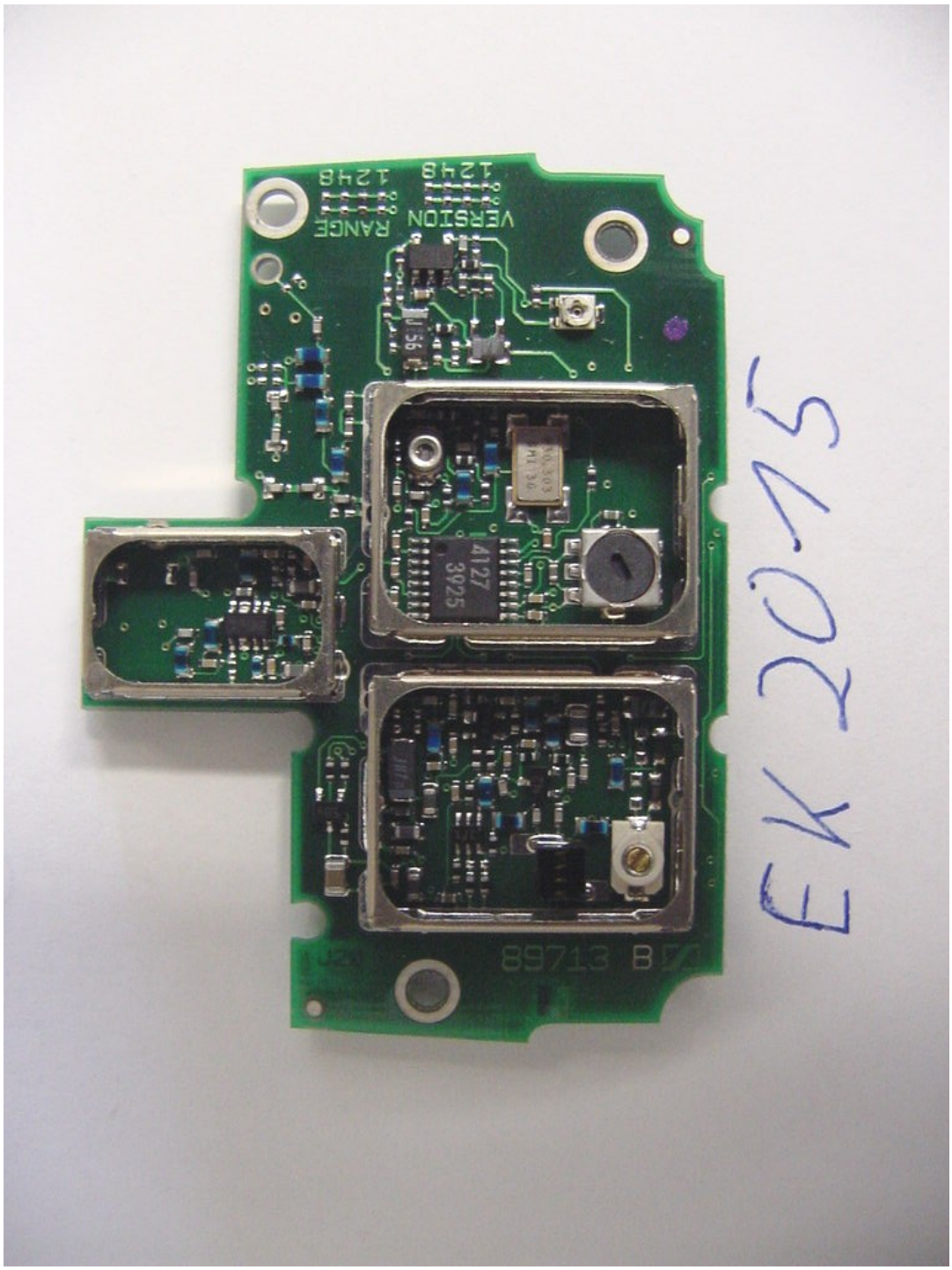
EK 2015
Photograph no.: 9

Photographs of the equipment

EK 2015
Photograph no.: 10

Photographs of the equipment

EK 2015 (RF-Board)
Photograph no.: 11



Photographs of the equipment

EK 2015 (RF-Board)
Photograph no.: 12