

TEST REPORT NO.:**BML – FC 009.2006**

Test specification: CFR47 part 15 Radio Frequency Devices.

Sub standard: FCC 15 subpart B/C Unintentional/Intentional Radiators.

Ordered by: C81 Philippe project team – ABK

Address: Lindholm Brygge 35, 9400 Nr.Sundby
Denmark

Subject: BenQ-Siemens C81

Verification: Travel Charger – Friwo type – A5BHTN00 180751, sample FR_WR85_US_B2_06
Desktop Stand – EDS-100 – S30880-S2611-A115-1, B1-v.2.* (Not all scenarios)

Headset Basic – HHS-100 - S30880-S2611-A515, v. 1.5.1
Headset – HHS-110 - S30880-S2611-A525, v.1.5.1
Headset Purestyle - HHS-120 - S30880-S2611-A555, v.1.6.1
Headset Stereo – HHS-150 – S30880-S2611-A535, v.1.5.1
Car Kit Portable – HKP-100 – S30880-S2611-A305-1, B2-v.3.4.1
Car Charger Plus – ECC-100 – C39280-Z4-C459, v.1.1.1
Data Cable – DCA-100 (RS232) – S30880-S2611-A805-1
Data Cable – DCA-140 (USB) – S30880-S2611-S835
Sync station – DSC-100 (DCA-140+EDS-100) – S30880-S2611-Axxx (Not selected for test)

Spare battery – V30145-K1310-X326-NT – 3.7V/820 mAh
Spare battery – V30145-K1310-X329-SM – 3.7V/820 mAh

Serial numbers: Sample #52, IMEI: 004401490002512 and
sample #177, IMEI: 004401490002504

HW revision: B2

SW revision: 00 baseline 1.0_V79.1.9.1

Manufacturer:

Manufacturer	BenQ Mobile GmbH & Co OHG
Street Address	Südstrasse 9
City/Zip Code	D-47475 Kamp-Lintfort
Country	Germany

BML TESTING LABORATORY (NO. 1)
for Electro-Magnetic Compatibility

Internal Order No.: PKN – 27.03.2006.009

Date(s) of test: 28.03.2006 -> 18.04.2006

Technical responsibility	Test performed by:
Per K. Nielsen 	Jan Clausen 
Date: 20.04.2006	Number of pages: 26

All test results are valid only and exclusive for the equipment under test, (EUT).

Summary: The equipment tested is compliant to the above mentioned specification.

TEST REPORT NO.: BML – FC 009.2006

Radiated and Conducted Emission

References

CFR 47	FCC 15 subpart B, Unintentional Radiator. FCC 15 subpart C, Intentional Radiator.
CISPR 22	Information Technology Equipment – Radio disturbance characteristics Limits and Methods of measurement, CISPR 22:1997, modified + Amendment 1 (EN 55022/A1 (October 2000)) + Amendment 2 (EN55022/A2 (2002))
ANSI C63.4	Methods of Measurements of Radio-Noise Emissions from Low-voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz, ANSI C63.4-2000.
CISPR/ I/WG4/02-02	CISPR 22 and IEC 61000-6-3 emission limits above 1 GHz, September 2002

Enclosures

Conversion factors.doc	Field strength conversion factors and other data formats and exchange of formats.
--	--

Revision Information

Created:	Revision	Name	Comments
19.08.03	0.1	Nielsen Per Klaus	Initial revision in PVCS
Modified			
20.04.06	1.0	Nielsen Per Klaus	Measurement results added

Contents

1	Introduction.....	5
2	Description of test set up	6
2.1	GSM 1900 specific	8
2.2	Bluetooth specific	8
2.3	Environmental conditions	9
2.4	Test equipment.....	9
2.5	Calibration	11
3	Emission detection	11
4	Pass criteria for the test	12
4.1	Exceptions.....	13
5	Test and evaluation conditions	13
6	Results.....	14
6.1	Environmental conditions	14
6.2	Detected emissions	14
6.2.1	The FCC §15.209 Intentional Radiators – Standby mode.....	15
6.2.2	The FCC §15.247(c) Operation within the band 2400 – 2483.5 MHz.....	15
6.2.3	The FCC §15.31(h) combined GSM and Bluetooth test	15
6.2.4	The FCC §15.109(g) Charger tests	15
6.2.5	The FCC §15.107/207 Conducted emission.....	17
6.2.6	The FCC §15.109(g) Accessory tests.....	19
6.2.6.1	Mobile with headsets	19
6.2.6.2	Mobile with Car Chargers	21
6.2.6.3	Mobile with Car Kits	24
6.2.6.4	Mobile with Data solutions	25
7	Evaluation of test result.....	26

1 Introduction

In this report the selected radiated test according to FCC 15 subpart B and/or C for unintentional/intentional radiators with respect to the GSM 1900 operations are performed on the product C81 with accessories in the EMC facility in Pandrup. The test will facilitate the use of CISPR 22 as indicated in FCC 15.109(g) and FCC 15.107(e).

Furthermore the conducted tests according to FCC 15.107(e) for the mobile C81 attached to US chargers are also performed.

BenQ Denmark ApS

Lindholm Brygge 35
DK-9400 Nr.Sundby
Denmark

Switchboard
+45 7219 5000

CVR No.
27963706

20.04.06 /bmlpkn
Revision: 1.0, Page 5 of 26
C81 - CISPR 22 (FCC 15) EMI 20-04-2006

The test overview is given below:

- FCC §15.209: GSM 1900 Idle mode (30 MHz – 19.1 GHz)
- FCC §15.209: Bluetooth standby mode (30 MHz – 25 GHz)
- FCC §15.109: FM radio emissions on 3 channels according to FCC §15.31(m) and FCC §15.33(b)(1) with respect to the frequency range.
- FCC §15.247(c) Bluetooth emission in connected mode (30 MHz – 25 GHz). For the limit line the §FCC 15.205(a) and FCC §15.209(a) apply.
- FCC §15.31(h) Combined test of Bluetooth and GSM1900 operating simultaneously. If applicable the test should be repeated for both radiated and conducted emission.
- FCC §15.107/207 Conducted emission test in the range 450 kHz – 30 MHz with various chargers. The LISN network is specified in FCC §15.33(l). Adopting FCC §15.107(e) for using the CISPR 22 testing approach.
- FCC §15.109(g) Radiated emission for various AC chargers and accessories. Uses CISPR 22 as guideline for the selected tests.

2 Description of test set up

The test set up used for radiated spurious emission test for a mobile operated in idle mode follows the guidelines specified in the §15.31 (ANSI C63.4) and §15.33 with respect to intentional and/or unintentional transmitters.

The general test layout is taken care of in the construction of the chambers and measurements site of the facility. However the following guidelines derived from the standard concerning the handling of the product to be tested have to be followed.

According to the standard tests specified has been written for open-air test site measurements. At Siemens Mobile Phones a 3-meter semi-anechoic chamber will be used for the measurements. The chamber is approved with respect to EN50147-1 (Shielding Effectiveness), FU (Field of Uniformity), NSA (Normal Site Attenuation) and TL (Transmission Loss) in the range from 26 MHz to 18 GHz as required in §15.31 for FCC measurements within a chamber.

The facility itself is therefore approved according to the following standards by independent institutes:

- Shielding effectiveness: EN 50147 – 1 (10 kHz – 18 GHz).
- NSA (Normal Site Attenuation): CISPR 16 or ANSI 63.4 / 63.5.
- Free Space Transmission Loss: EN 50147 – 2 (30 MHz – 18 GHz).
- FU (Field of Uniformity): EN 61000 - 4 – 3 (30 MHz – 18 GHz).

In the range from 30 MHz to 1000 MHz the set up must follow the guidelines specified in ANSI C63.4 using a conducted ground plane. However above 1 GHz the floor must be fully covered by absorbers, see chamber layout in figure 2.1. For measurement below 1 GHz leaving in the absorbers on the floor the emissions measured must be more than 6 dB below the limit as specified in §15.109 and/or §15.209.

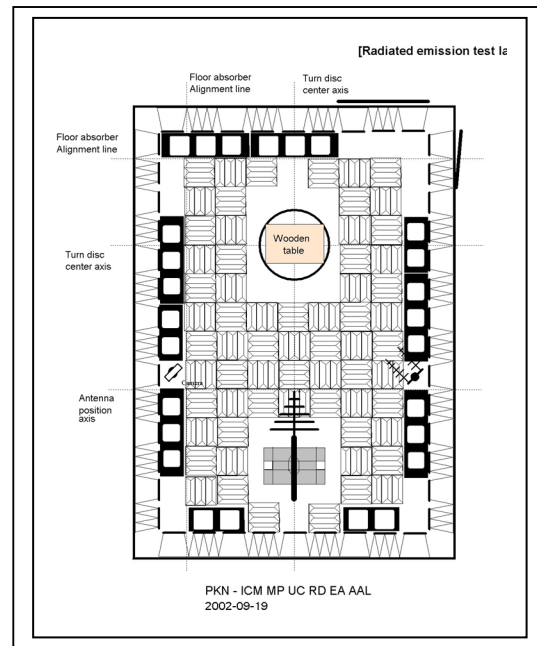


Figure 2.1 Absorber layout for radiated spurious emission test.

The product has to be mounted on a pedestal in a height of 1.5 meters for stand-alone measurements. The measurement antenna shall be mounted and fixed at the same height as the product. The measurement antenna length must not exceed 20% of the measurement length e.g. at 3 meter distance the length of the measurement antenna must not exceed 0.6 meters. For tabletop layout the product with accessories attached is mounted on a table 0.8 meters above the ground floor. The measurement antenna is thus placed at 1-meter height.

The test must be performed at both normal and extreme voltage conditions. A battery simulator should be used to keep the mobile at the specified extreme voltage when appropriate. However means to avoid the influence of the power supply connection to the battery simulator with respect to the measurement results should be accomplished. The extreme voltages for the battery type used in the product are specified as:

<i>Battery type: Lithium Ion</i>		
Voltage level	Voltage value	Power supply set up
Low	3.4 V (Active slot)	Battery simulator only
Normal	3.7 V	Battery supply only
High	4.2 V	Battery simulator only

The tests have to be performed while the product is operated in receive only mode on any supported band, except for Bluetooth which also has to be tested in connected mode. The test are also repeated with the receive antenna in both horizontal and vertical position while the mobile is rotated 360 degrees. The emissions limits specified in either §15.109 or §15.209 for class B devices are identical above 30 MHz, see chapter 4.

For the extreme voltage tests (if any) a battery simulator is used to ensure a stable and controllable power supply voltage during the test.

2.1 GSM 1900 specific

Test channels used by the CMU-200 GSM emulator during test:

- GSM 1900 channel 661 (1880.0 MHz) for the uplink TCH channel.
- GSM 1900 channel 661 (1960.0 MHz) for the downlink TCH channel.
- GSM 1900 channel 658 (1879.4 MHz) for the downlink BCCH channel

Since the mobile with respect to GSM is only operated in Idle mode it is considered to be an intentional radiator according to FCC §15.209 hence the upper limit of the frequency area to be scanned for spurious emission are specified to the 10.th harmonics e.g. 19.1 GHz due to the upper frequency in the GSM1900 band according to FCC §15.33(a)(1).

2.2 Bluetooth specific

For Bluetooth the Standby mode is tested against FCC §15.209 and the connected mode is tested against FCC §15.247(c) up to the 10.th harmonic according to FCC §15.33(a)(1) e.g. 25 GHz. The chamber in Pandrup is limited to 20 GHz due to equipment and calibration limitations.

For the CMU-200 Bluetooth testing the following channels were used for the mobile uplink:

- Low channel – 0 at 2402 MHz.
- Mid channel – 39 at 2441 MHz.
- High channel – 78 at 2480 MHz.

In all Bluetooth test the downlink carrier from the CMU-200 was located at channel 21.

2.3 Environmental conditions

For radiated spurious emission test the following environmental conditions applies:

- Ambient temperature between 15 °C to 35 °C.
- Relative humidity in the range 20 % to 75 %.

The environmental conditions are recorded for this report.

2.4 Test equipment

The test equipment used to perform the test according to FCC 15 is:

Equipment	Type and identification	Operational range	Date of calibration
EMI analysers	HP E7405A S/N US39440168	9 kHz – 26.5 GHz	06.03.06
	ESIB 26 S/N 100179	20 Hz – 26.5 GHz	30.03.06
Arbitrary Waveform function generator	HP 33120A S/N US36043114	0 - 15 MHz	10.03.06
Pre Amplifiers	EA PA-02 S/N 0800002: (JCA12-300 JCA24-300 JCA 48-300 JCA812-400 JCA1218-500)	1 – 18 GHz 1 GHz – 2 GHz 2 GHz – 4 GHz 4 GHz – 8 GHz 8 GHz – 12 GHz 12 GHz – 18 GHz	20.06.02
	Sonoma 310N S/N 185680	9 kHz – 1 GHz	19.06.02
	Miteq AFS4-02001800-35-ULN 2-18 GHz	2 GHz – 18 GHz	11.01.06
	SMP 22 S/N 847399/001	10 MHz – 20 GHz	06.03.06
RF signal generator	CMU 200 S/N 834639/003	GSM 850, GSM900, R- & E-GSM, GSM1800, GSM1900 Bluetooth	10.03.06
Filter section			
Low Pass filters	SLP 550	(600 MHz)	19.06.02
	WLK 790-10SS S/N 1	(820 MHz)	19.06.02
	WLK 1610-10SS S/N 1	(1680 MHz)	19.06.02
	WLK 1750-10SS S/N 1	(1780 MHz)	19.06.02
Notch filters	TWNC 8604-1 S/N 010893056	790 – 1000 MHz (836.6 MHz)	14.06.02
	WRCA 800/960-0.2/40-6SSK S/N 2	800 – 960 MHz (824.2 MHz)	05.11.03
	TWNC 8604-1 S/N 129	760 - 1000 MHz (848.8 MHz)	05.11.03
	WRCA 800/915-0.2/40-6SSK S/N 1	800 – 915 MHz (902.4 MHz)	24.03.03
	WRCD 1710/1785-0.2/40-10SSK S/N 1	1710 – 1785 MHz (1747.6 MHz)	19.06.02
	WRCD 1850/1910-0.2/40-10SSK S/N 1	1850 – 1910 MHz (1880.2 MHz)	19.06.02
	WRCD 1700/2000-0.2/40-10SSK S/N 3	1700 – 2000 MHz (1850.2 MHz)	05.11.03
	Procom BRF 1700/3 S/N 140197042	1850 – 1910 MHz (1909.8 MHz)	05.11.03
	WRCT 2441-0.3/50-10EE S/N 1	2400 – 2484 MHz (2441.0 MHz)	03.07.03
High Pass filters	WHKS2250-8SS S/N 1 and S/N 2	(2250 – 18000 MHz)	-
	WHKS800-8SS S/N 1 and S/N 2	(800 – 3000 MHz)	-
	WHKS500-6SS S/N 1	(500 – 3000 MHz)	-
	WHKS300-6SS S/N 1 and S/N 3	(300 – 3000 MHz)	-
	WHKS200-6SS S/N 1	(200 – 3000 MHz)	-
	K&L 3DH1 1500/T13000- 0/0 S/N 3	(1400 –20050 MHz)	08.03.04
	K&L 3DH1 1500/T13000- 0/0 S/N 2	(1400 – 20000 MHz)	-
	Trilithic 3HC 1900/18000-1-KKS S/N 200016148	(1680 – 18900 MHz)	09.03.04
	Trilithic 4HC 2900/18000-1.1-KK S/N 200016154	(2440 - 20000 MHz)	19.02.02
	Trilithic 4HC 2900/18000-1.1-KK S/N 200016155	(2550 – 20050 MHz)	08.03.04
	K&L 3DH1-2500/T13000-0/0 S/N 2	(2100 – 20000 MHz)	-
	K&L 3DH1-3000/T13000-0/0 S/N 8	(2700 – 20000 MHz)	03.07.03

	K&L 3DH1-3000/T13000-0/0 S/N 3	(2700 - 20000 MHz)	11.01.06
BandPass filters	Siemens made	(600 – 1200 MHz)	-
Bypass filters	BLKHD 6N – 8N + 7N-5N	(9 kHz - 20000 MHz)	08.03.04
Splitters	HP 11667A S/N 50524	(DC – 18 GHz)	-
	Norsal Ind. 8812 S/N 111	(0.5 – 2.0 GHz)	-
SW platform			
EMC SW	EMC Automation EA Standard emission test ver. 8.53	EN 301 489 – 1 EN 301 489 – 7 TS 51.010-1 FCC part 15, 22, 24	27.08.00

Table 2.1 Equipment used for EMC testing of the FM radio receiver including a general passive device list. The not calibrated devices are only used for noise shielding of the test equipment and they do not need to be calibrated for that purpose.

	- GSM 850.
	- GSM 900.
	- GSM 1800.
	- GSM 1900 - Share high pass filter with GSM 1800.
	- Bluetooth - Share low and high pass filter with GSM 1900.
	- Path used for standby and Idle measurements.
	- Devices mounted on the double rigid horn antenna S/N 9907-5897.
	- FM radio.
	- CMU-200 protection circuit devices for immunity tests.
	Interchanged if needed.

The antennas used in the various tests are listed in the below table. All the log-periodic antennas are used as communication and link establishment antennas for either (GSM, FM and/or Bluetooth).

Antenna	Type and identification	Operational range	Date of calibration
Hybrid-log periodic	HLP 3003C S/N 080200	30 MHz – 3 GHz	9.07.00
Hybrid-log periodic (Spare)	HLP 3003C S/N 060300	30 MHz – 3 GHz	9.05.00
Horn (BT/WLAN link)	AT 4002A S/N 28547	0.8 GHz – 5 GHz	-
Horn (BT /WLAN link)	AT 4002A S/N 28548	0.8 GHz – 5 GHz	-
Double ridged horn w. 3 GHz high pass + 2-18 GHz pre-amp.	EMCO 3115 S/N 9907 – 5897	1 GHz – 18 GHz (19.1 GHz)	27.07.99 (21.06.02)
Double ridged horn (Substitution/spare)	EMCO 3115 S/N 9907 - 5896	1 GHz – 18 GHz	27.07.99
Double rigid horn	EMCO 3116 S/N 2637	18 GHz – 40 GHz	28.05.02
Log-periodic (GSM link)	LPDA 8030 S/N 090200	800 MHz – 3 GHz	9.05.00
Log-periodic (GSM link)	LPDA 8030 S/N 090100	800 MHz – 3 GHz	9.05.00
Log-periodic (GSM link)	PLP 3003 S/N 021701	200 MHz – 3 GHz	05.02.01
Log-periodic (GSM link)	PLP 3003 S/N 021801	200 MHz – 3 GHz	05.02.01
Log-periodic (GSM/BT link)	LPDA 8060E S/N 072401	800 MHz – 3 GHz	-
Biconical (FM link)	PBA 2030 S/N 020501	20 MHz – 300 MHz	05.03.01
Biconical (FM link)	PBA 2030 S/N 020401	20 MHz – 300 MHz	09.02.01

Table 2.2 Antennas used for EMC testing. The Miteq amplifier and the K&L filter marked with rose colour in table 2.1 are mounted directly on the double rigid horn antenna from 1 – 18 GHz (19.1 GHz). The log-periodic antennas are only used for communication link establishments and not for emission/immunity testing.

The cables used to connect the antenna to the measurement system are calibrated the 11.01.06 in various combinations with respect to the total length of the cables put together:

The preferred measurement length for spurious emission is Semflex 5m(b) – 5m – 5m(l) that covers the path from distribution panel, at the input for the filter section to the antenna through the service

BenQ Denmark ApS

Lindholm Brygge 35
DK-9400 Nr.Sundby
Denmark

Switchboard
+45 7219 5000

CVR No.
27963706

20.04.06 /bmlpkn
Revision: 1.0, Page 10 of 26
C81 - CISPR 22 (FCC 15) EMI 20-04-2006

and Floor panel 1. The (l) parameter denotes a special 5-meter low Loss able and (b) denotes a Sucoflex cable.

The double rigid horn antenna is fitted with a preamplifier (Miteq) and a high pass filter (K&L) in order to measure with high performance above 3 GHz.

The signal path including filters, amplifiers etc. are all verified against previous calibration data in Marts 2005 and in January 2006.

2.5 Calibration

The calibration for the instruments are done according to the relevant standards by R&S Denmark A/S. System calibration (e.g. Filters, amplifiers, cable loss etc.) is done internally with the use of the already calibrated EMC facility equipment and/or stand-alone R&D equipment. System calibration data are stored in the facility system for use during measurements

The individual instrumentation calibration reports are stored in PDF format, and found on BenQ Denmark ApS laboratory network drive N.

3 Emission detection

To determine a detected spurious in the search band from 30 MHz – 10.0 GHz the following procedures have to be used.

- Perform a qualitative pre-search over the entire band for spurious emissions, which are higher than –20 dB from the limit.
- Perform a final scan or a substitution measurement to evaluate the exact level for each found spurious. (Radiated spurious emission only)

The spurious emission detection procedure is divided into several search-bands dependent on the equipment limitations and/or the specified filter and video bandwidth for the test. The filter and video bandwidth data for the radiated emission test are specified in ANSI C63.4:

- From 30 MHz to 1 GHz: RBW = 100 kHz
- Above 1 GHz: RBW = 1MHz

During the test the actual maximum of each detected spurious has to be found by turning the product 360 degrees around and/or move the measurement antenna up/down (If applicable) between 1 and 4 meters.

4 Pass criteria for the test

The pass criteria for the radiated test are defined in the standard §15.109:

Receive only mode: FM radio reception FCC §15.109 tables applies for class B devices:

§ 15.109 Radiated emission limits.	
(a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:	
Frequency of emission (MHz)	Field strength (microvolts/meter)
30–88	100
88–216	150
216–960	200
Above 960	500

Figure 4.1 Radiated emission limit table for unintentional radiator.

For intentional radiators like GSM and Bluetooth the emission limits are found in §15.209 for IDLE and Standby mode respectively.

§ 15.209 Radiated emission limits; general requirements.		
(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:		
Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100**	3
88–216	150**	3
216–960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54–72 MHz, 76–88 MHz, 174–216 MHz or 470–806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.

Figure 4.2 Radiated emission limit for intentional transmitter.

For Bluetooth in connected mode the limit is specified in FCC §15.247(c) as 20 dB below the radiated power (-20 dBc). The C81 Bluetooth part power class is designed for 0 dBm. However internal loss reduces the Bluetooth radiated power to -5 dBm +/- 0.3 dBm. The maximum limit for Bluetooth in connected mode is -25 dBm which is equal to 72.4 dBµV/m in 3-meter distance. The

limit line has to be combined with the requirements in FCC §15.205(a) frequency band exception lists where the limits defined in §FCC 15.209 applies.

The pass criteria for the radiated emission test according to CISPR 22 are listed in Figure 4.3

Limits for radiated emissions from ancillary equipment, measured on a stand-alone basis	
Frequency range	Limit (Quasi-peak)
30 MHz to 230 MHz	30 dBµV/m
> 230 MHz to 1 000 MHz	37 dBµV/m

Table 4.3 Radiated emission limit table as defined in CISPR 22.

The limits in table 4.3 are for 10-meter measurements. The calculations for the 3-meter set up is described in [EMC RF signal conversion factors.doc](#)

Then the limits at 3-meter distance are:

Frequency range	Limit (Quasi-peak)
30 MHz to 230 MHz	40.45dBµV/m
>230 MHz to 1000 MHz	47.46dBµV/m

Table 4.4 Emission limits converted to 3-meter distance.

The test was performed with the floor covered with absorbers (Fig 2.1). According to CISPR/I/WG4/02-02, the limit should be lowered by 5 dB to compensate for the non-reflective floor and no height scan. To obtain a safe margin the limit is lowered 6 dB.

4.1 Exceptions

For measurements in an anechoic chamber pre-calibration data may be used instead of a substitution measurement to determine the level of any found spurious emission from the product.

5 Test and evaluation conditions

The level of any found spurious emissions must not exceed the levels specified in §15.109, §15.209 or CISPR 22 whichever is applicable.

According to §15.35(b) an average detector must be used in measurements above 1 GHz. If a peak detector has been used instead of the average detector for emissions above 1 GHz then the limit is raised by 20 dB. By other means any spurious emissions detected above the limits specified in chapter 4 of this report has to be reduced by 20 dB to compensate for the use of the peak detector.

For Bluetooth connected test the level of any found spurious must not exceed the level specified in FCC §15.247(c) defined for 3-meter measurement distance in chapter 4. For any emissions found in the bands shown in figure 5.1 the limits of FCC §15.209 apply, see figure 4.2.

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
¹ 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	2655–2900	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	(²)
13.36–13.41			

¹ Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.
² Above 38.6

Figure 5.1 The table of restricted emission bands where the limit for Bluetooth according to FCC §15.247(c) does not apply but the limits of FCC §15.209 is adopted instead.

As an exception to the Bluetooth limit restrictions shown in figure 5.1 only spurious emissions are allowed within these bands (radiation of harmonics).

6 Results

The measurement results are listed in the below schematic. The tests are performed for the C81 operated in various modes as described in each paragraph of test results.

6.1 Environmental conditions

The recorded environmental conditions during the test were:

Item	Value
Temperature	21 °C +- 2.5 °C
Humidity	53 % +- 5 %
Anechoic chamber	Yes

6.2 Detected emissions

The found spurious emissions are listed in the below graphs and tables for each mode of operation. For all measurements reported in this chapter a peak detector was used unless stated otherwise.

6.2.1 The FCC §15.209 Intentional Radiators – Standby mode

The FCC §15.209 paragraph for class B devices was used for the GSM 1900 Idle mode and Bluetooth standby mode test.

For the purpose of this report, these tests results are omitted.

6.2.2 The FCC §15.247(c) Operation within the band 2400 – 2483.5 MHz

In this paragraph the tests for Bluetooth emission according to FCC §14.247(c) in connected mode is performed on 3 channels (0, 39 and 78). The CMU-200 was operated in single TX/RX channel mode only.

For the purpose of this report, these tests results are omitted.

6.2.3 The FCC §15.31(h) combined GSM and Bluetooth test

As specified in FCC §15.31(h) different radio bands that can operate simultaneously have to be tested in a combined emission test. Since we only had one CMU-200 the test was performed using a Bluetooth headset operating in normal mode while we used the CMU-200 for the GSM 1900 communication link.

For the purpose of this report, these tests results are omitted.

6.2.4 The FCC §15.109(g) Charger tests

The chargers (standard and/or travel charger) were measured without desktop stand according to FCC §15.109(g) that specify the usage of CISPR 22 for radiated emission tests. The scenario with desktop stand has been omitted as it was not considered to be worst case. The usage of CISPR 22 for the conducted emission test according to FCC §15.107(e) requires the radiated emission test in FCC §15.109(g).

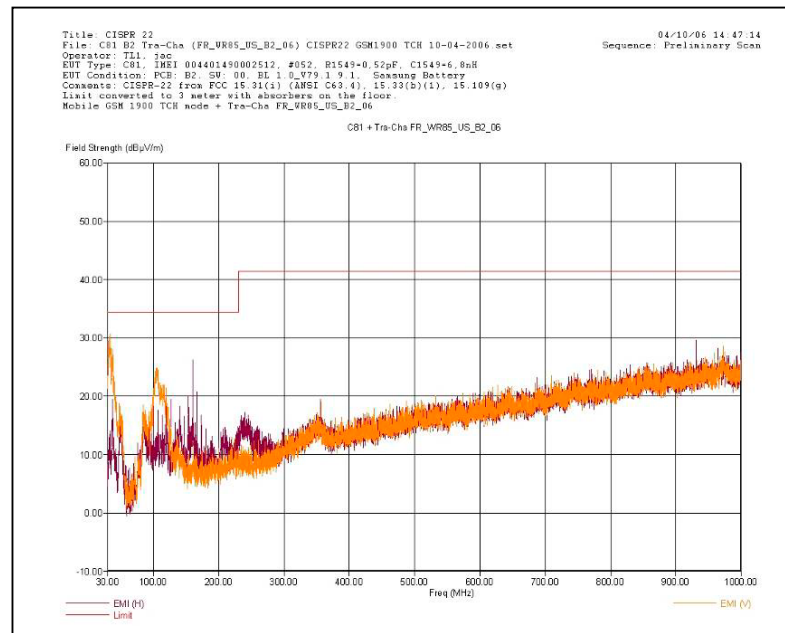


Figure 6.1

The radiated emission for the C81 sample #052 in GSM 1900 TCH mode connected to a Travel Charger US measured according to the guidelines in CISPR 22. Limit line converted to fully absorber-lined chamber by subtracting 6 dB.

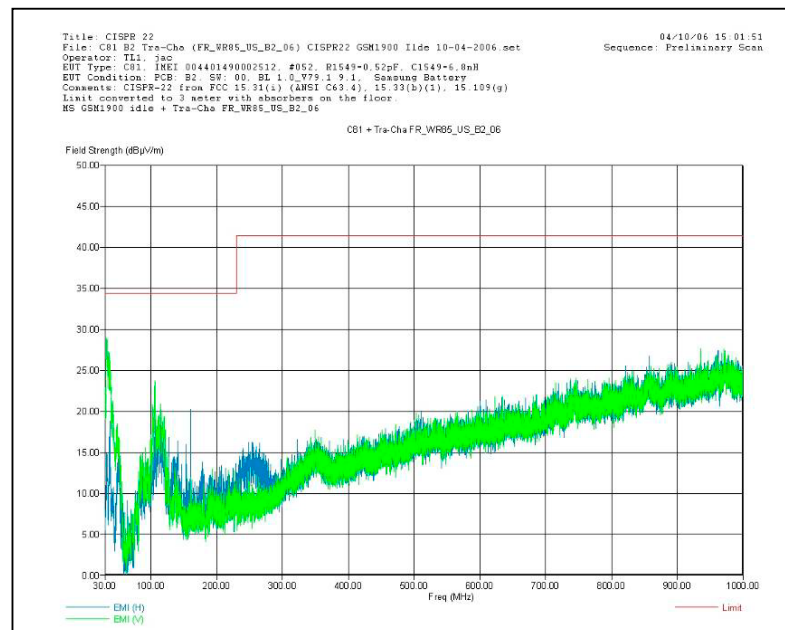
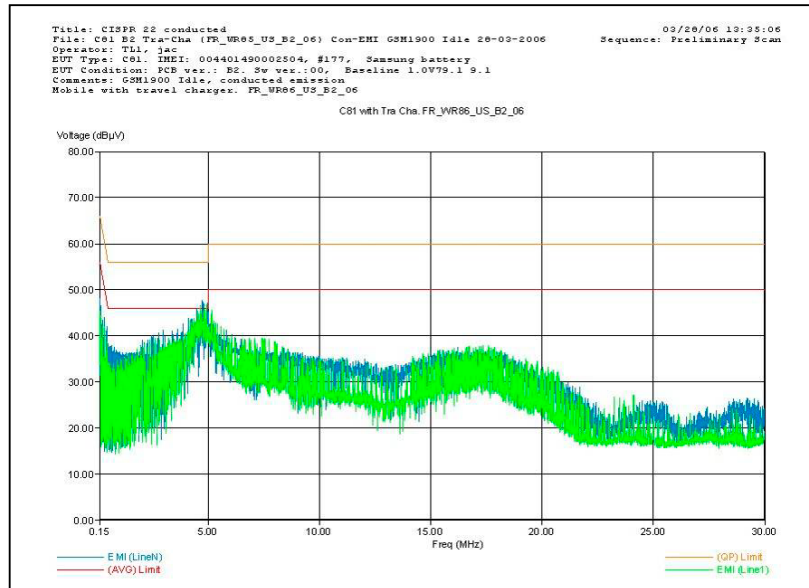


Figure 6.2

The radiated emission for the C81 sample #052 in GSM 1900 Idle mode connected to a Travel Charger US measured according to the guidelines in CISPR 22. Limit line converted to fully absorber-lined chamber by subtracting 6 dB.

6.2.5 The FCC §15.107/207 Conducted emission

The charger and desktop stand were tested against FCC 15.107(e) using CISPR 22 conducted test procedure.



Title: CISPR22 conducted
File: C01 E2 Tra-Cha (FR_WR05_US_B2_06) Con-EMI GSM1900 Idle 20-03-2006 - AV Sequence: Final Measurements
Operator: TL1, jac
EUT Type: C01, IMEI: 004401490002504, #177, Samsung battery
EUT Condition: PCB ver.: B2, Sw ver.:00, Baseline 1.0V79.1 9.1
Comments: GSM1900 Idle, conducted emission
Mobile with travel charger. FR_WR05_US_B2_06

03/20/06 12:41:44

C01 + Tra Cha.

Freq (MHz)	(AVG) EMI (dBµV)	(AVG) Limit (dBµV)	(AVG) Margin AVL (dB)	Line
4.66	30.95	46.00	-15.05	L1
4.74	24.87	46.00	-21.13	N
4.79	30.04	46.00	-15.96	N
4.92	24.77	46.00	-21.23	L1

Figure 6.3

The conducted emission for C81 connected to a travel charger US using CISPR 22 limits. The C81 was operated in GSM 1900 TCH mode while charging on an empty battery.

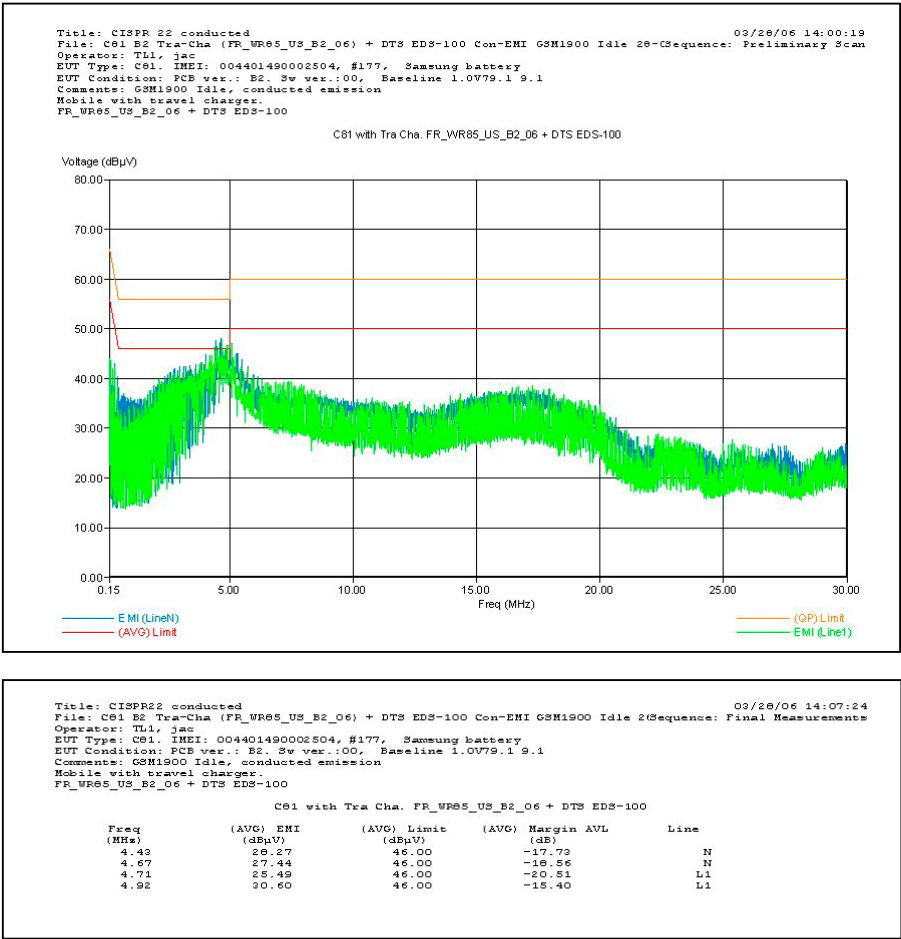


Figure 6.4 The conducted emission for C81 connected to a Desktop stand (EDS-100) with a travel charger US attached using CISPR 22 limits. The C81 was operated in GSM 1900 Idle mode while charging on an empty battery.

6.2.6 The FCC §15.109(g) Accessory tests

The accessories like headsets, car kits, car chargers and data cables were tested against FCC §15.109(g) using CISPR 22 for radiated emission tests for showing compliance to the limits of the CISPR 22 standard.

6.2.6.1 Mobile with headsets

Four different headsets are listed as accessories for the C81.

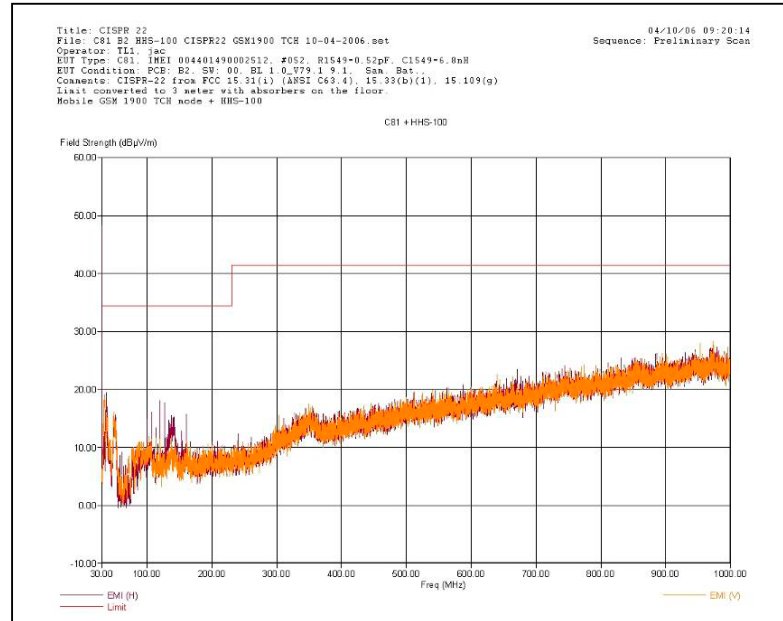


Figure 6.5

The radiated emission for the C81 sample #052 in GSM 1900 TCH mode connected to the Headset Basic (HHS-100) measured according to the guidelines in CISPR 22.

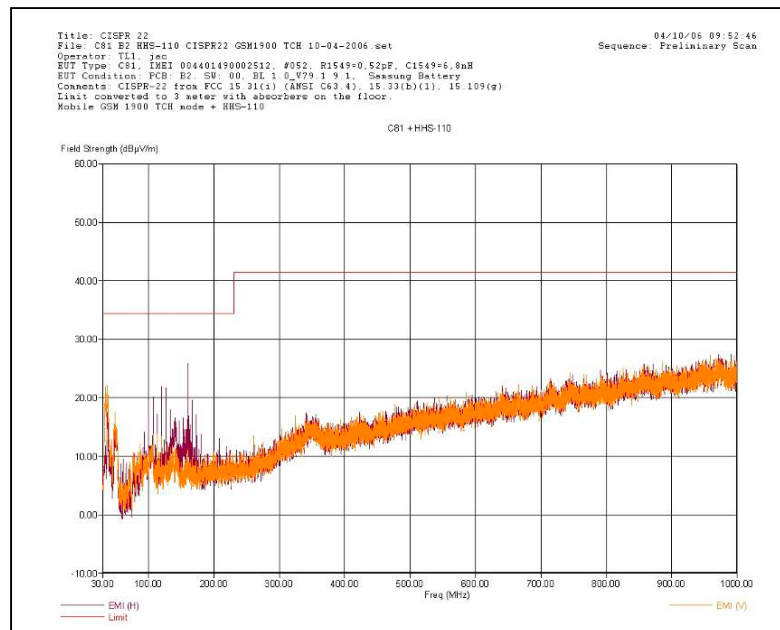


Figure 6.6

The radiated emission for the C81 sample #052 in GSM 1900 TCH mode connected to the Headset (HHS-110) measured according to the guidelines in CISPR 22.

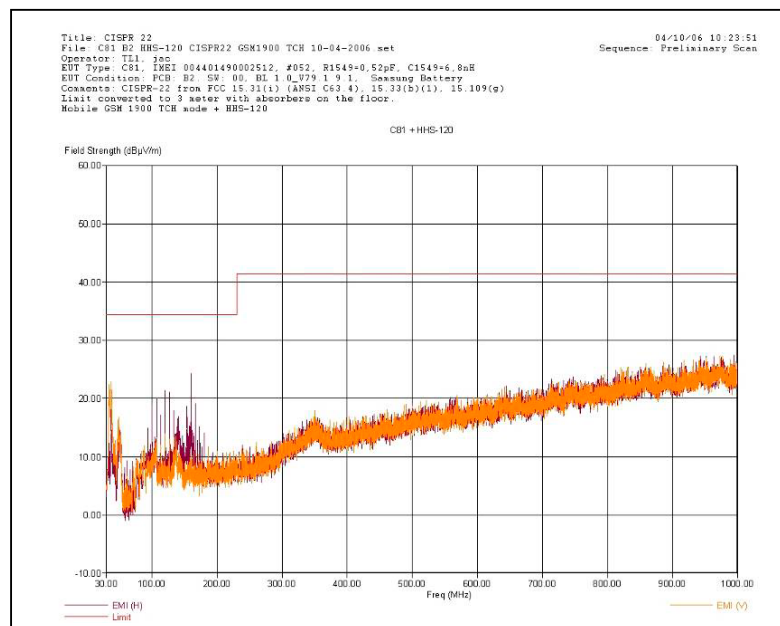


Figure 6.7

The radiated emission for the C81 sample #052 in GSM 1900 TCH mode connected to the Headset Purestyle (HHS-120) measured according to the guidelines in CISPR 22.

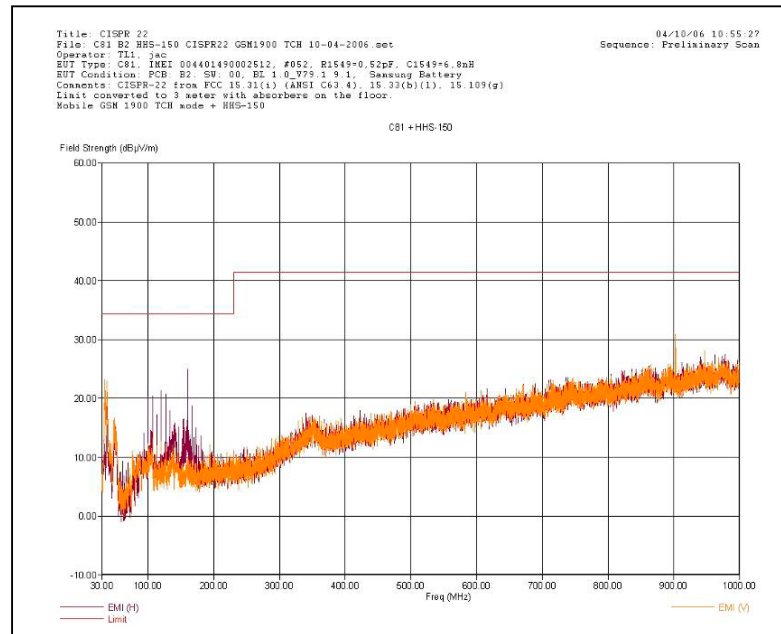


Figure 6.8 The radiated emission for the C81 sample #052 in GSM 1900 TCH mode connected to the Headset Stereo (HHS-150) measured according to the guidelines in CISPR 22.

6.2.6.2 Mobile with Car Chargers

The car charger plus is selected as an accessory for the C81. The car charger plus can also be connected to a headset while charging in a car. Both the standalone and the combined mode are tested in worst case configuration only.

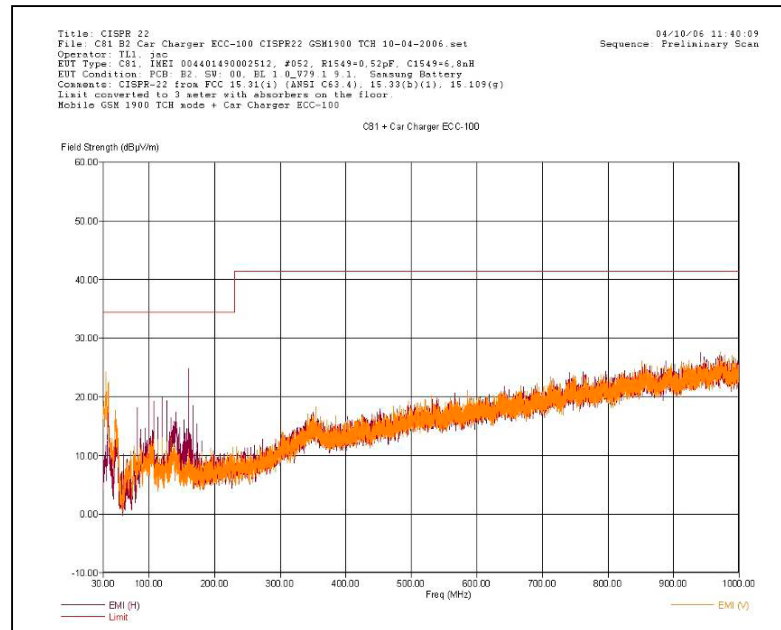


Figure 6.9

The radiated emission for the C81 sample #052 in GSM 1900 TCH mode connected to the Car Charger Plus (ECC-100).

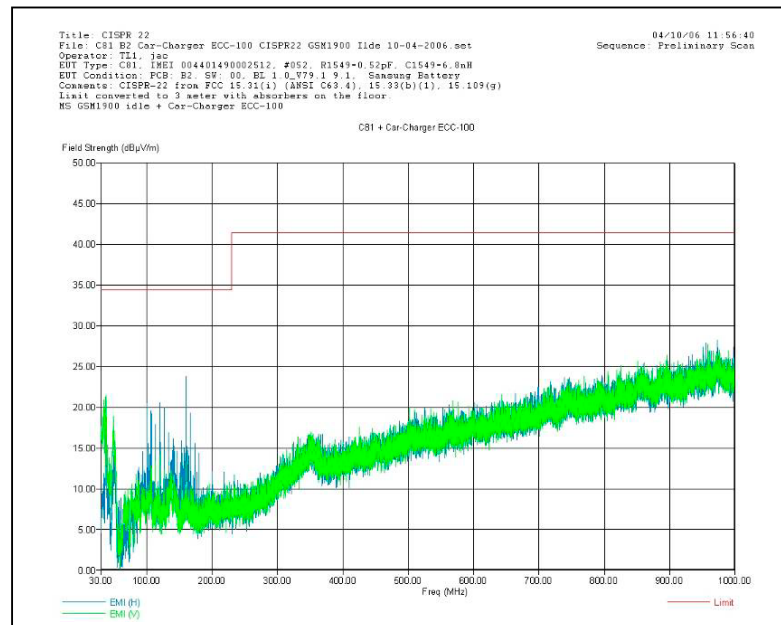


Figure 6.10

The radiated emission for the C81 sample #052 in GSM 1900 Idle mode connected to the Car Charger Plus (ECC-100).

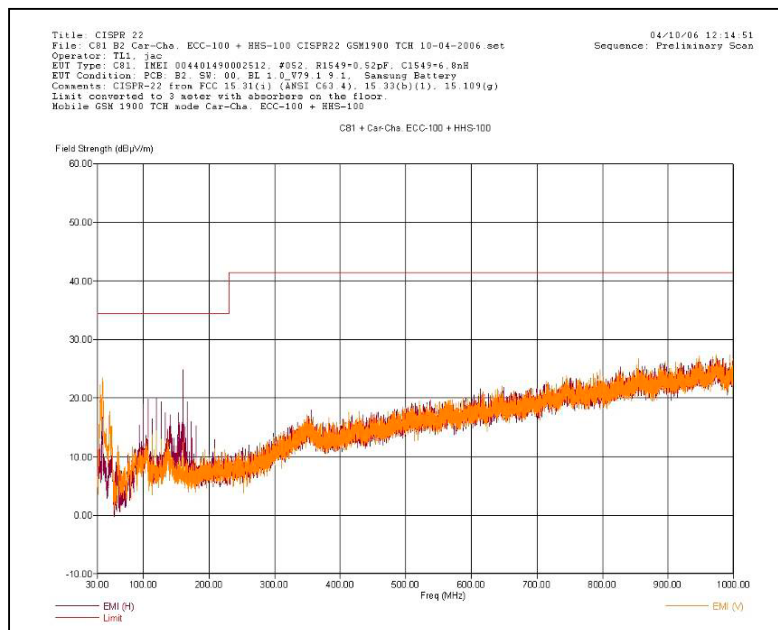


Figure 6.11

The radiated emission for the C81 sample #052 in GSM 1900 TCH mode connected to the Car Charger Plus (ECC-100) with Headset Basic (HHS-100) attached.

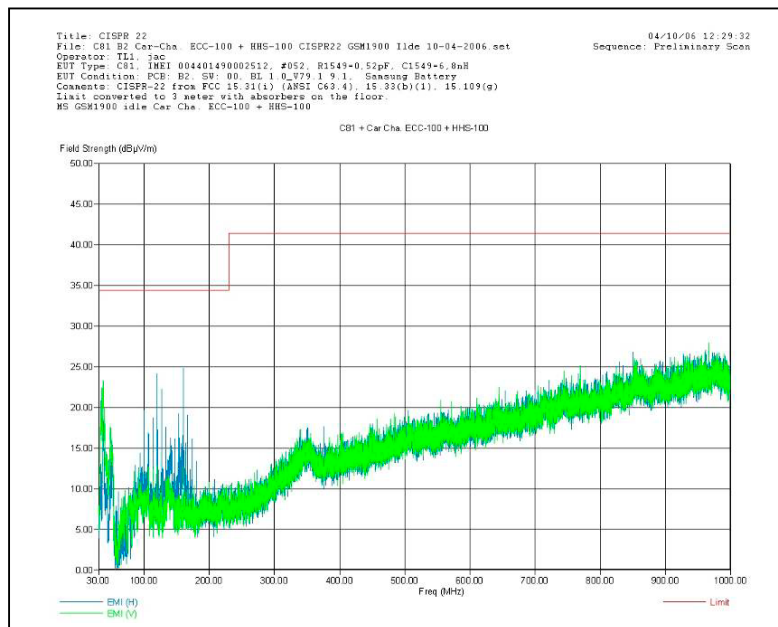


Figure 6.12

The radiated emission for the C81 sample #052 in GSM 1900 Idle mode connected to the Car Charger Plus (ECC-100) with Headset Basic (HHS-100) attached.

6.2.6.3 Mobile with Car Kits

For the C81 the Car Kit Portable has been selected as an accessory.

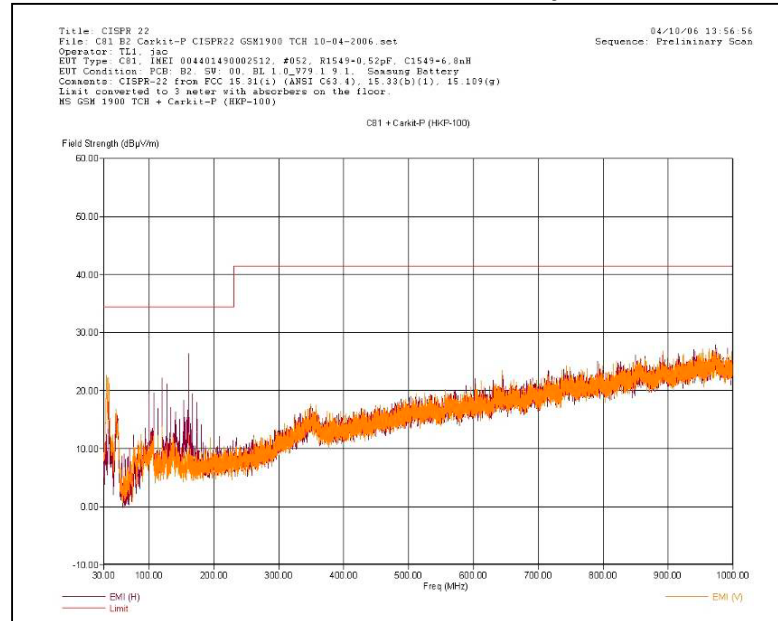


Figure 6.13

The radiated emission for the C81 sample #052 in GSM 1900 TCH mode connected to the Car Kit Portable (HKP-100).

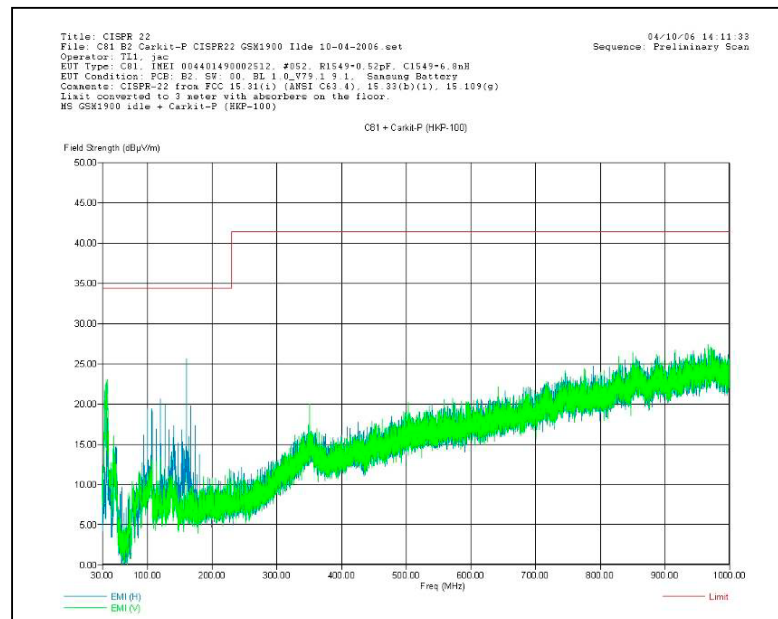


Figure 6.14

The radiated emission for the C81 sample #052 in GSM 1900 Idle mode connected to the Car Kit Portable (HKP-100).

6.2.6.4 Mobile with Data solutions

Two types of data cable solutions are selected for the C81. One data cable is with a RS-232 interface and the other is with a USB interface. The Sync station is not selected for test as it contains the data cable USB.

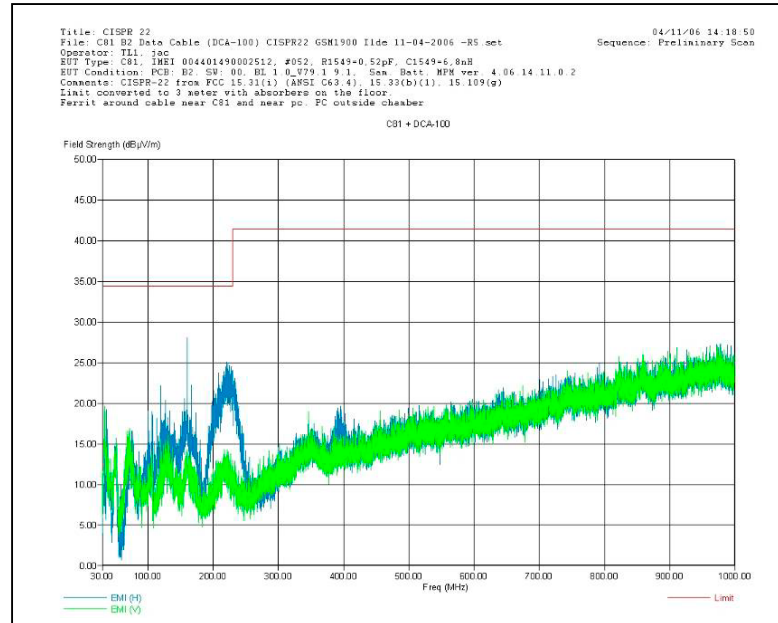


Figure 6.15

The radiated emission for the C81 sample #052 in GSM 1900 Idle mode connected to the Data Cable (DCA-100).

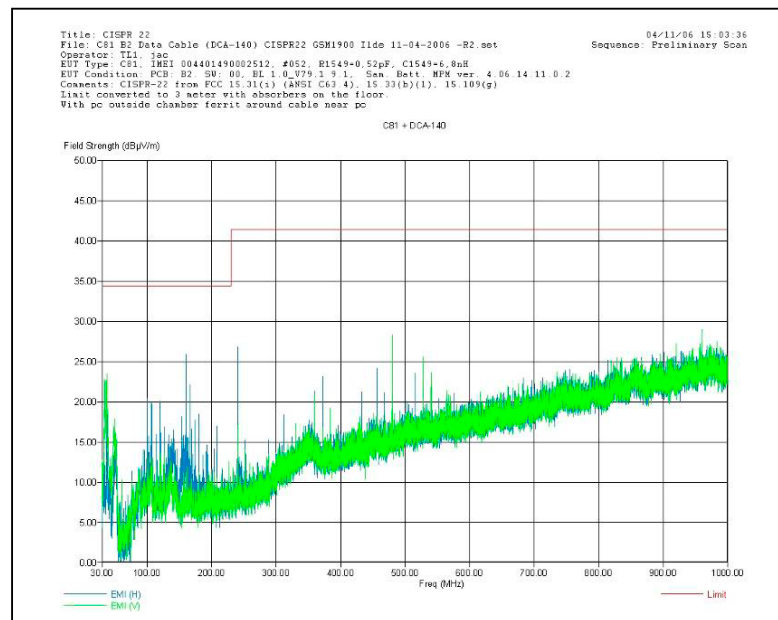


Figure 6.16

The radiated emission for the C81 sample #052 in GSM 1900 Idle mode connected to the Data Cable (DCA-140).

7 Evaluation of test result

The overall test result for the selected tests according to FCC 15 subpart B/C is PASS.

Radiated emissions for the C81 attached to chargers and accessories measured according to FCC §15.109(g)/FCC §15.107(e) using CISPR 22 is PASS.

The following comments to the test have been derived.

- Only test under nominal battery voltage conditions performed.
- Extreme voltage conditions using battery simulator not performed.

Conclusion:

The C81 has been evaluated against the CISPR 22 as described in FCC §15.109(g)/FCC §15.107(e) with respect to the emission performance in conjunction with chargers and accessories. The C81 is for the selected test scenarios tested compliant to the criteria's defined in CFR47, FCC 15 subpart B/C.

/end.