TEST REPORT No.: 02001427
Date : 2002.09.22

EQUIPMENT UNDER TEST:	**DSS Anti-theft device "Operating Key"**
Trade Name:	HILTI DSS
Model:	00160204 Operating Key
Serial No:	none
Equipment Category:	Transceiver
Manufacturer:	TeraTron GmbH
Address:	Robert-Wilhelm-Bunsen-Strasse 5 D-51647 Gummersbach
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RELEVANT STANDARD:	47 CFR Part 15C - Intentional Radiators
USED:	ANSI C63.4-1992

TEST REPORT PREPARED BY:

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CONTENTS

1 GENERAL INFORMATION 4
1.1 Purpose 4
1.2 Limits and Reservations 4
1.3 Test Location 4
1.4 Manufacturer 4
1.5 Dates 4
2 PRODUCT DESCRIPTION 5
2.1 Equipment Under Test (EUT) 5
2.2 EUT Peripherals 5
2.4 Modifications Required for Compliance 5
4 ANTENNA REQUIREMENT 7
4.1 Regulation 7
4.2 Result 7
5 RADIATED EMISSIONS 8
5.1 Regulation 8
5.2 Test Equipment 9
5.3 Test Procedures 9
5.4 Calculation of Field Strength Limits 10
5.5 Calculation of Average Correction Factor 10
5.6 Field Strength Calculation 10
5.7 Test Results 11
5.7.1 Model 00160204 Operating Key 11
6 CONDUCTED EMISSIONS TESTS 12
6.1 Regulation 12
6.2 Test Equipment 12
6.3 Test Procedures 12
6.4 Test Results 12
7 PERIODIC OPERATION CHARACTERISTICS 13
7.1 Periodic Operation 13
7.1.1 Regulation 13
7.1.2 Result 13
7.2 Manually Operated Transmitter Deactivation 13
7.2.1 Regulation 13
7.2.2 Result 13
7.3 Automatically Operated Transmitter Deactivation 14
7.3.1 Regulation 14
7.3.2 Result 14
7.4 Prohibition of Periodic Transmission 14
7.4.1 Regulation 14
7.4.2 Result 14
7.5 Continuous Transmission During an Alarm Condition 14
7.5.1 Regulation 14
7.5.2 Result 14
8.1 Regulation 15
8.2 Calculation of 20 dB Bandwidth Limit 15
8.3 Test Equipment 15
8.4 Test Procedure 15
8.5 Test Result 15
8.5.1 Model : 00160204 Operating Key 15
9 PHOTOGRAPHS OF THE TEST SETUP 17
9.1 Radiated Ernissions Tests 17
9.1.2 Photograph: EUT in horizontal polarization on the turntable 17
9.2 Conducted Emission Tests 18
10 MISCELLANEOUS COMMENTS AND NOTES 19

11 LIST OF ANNEXES.....20

1 GENERAL INFORMATION

1.1 Purpose

The purpose of this report is to show compliance to the FCC regulations for unlicensed devices operating under section 15.231 of the Code of Federal Regulations title 47.

1.2 Limits and Reservations

The test results in this report apply only to the particular Equipment Under Test (EUT) as declared in this report. This test report shall not be reproduced except in full without the written permission of m.dudde hochfrequenz-technik.

1.3 Test Location

Company Name:	m.dudde high frequency technology
Street:	Rottland 5a
City:	51429 Bergisch Gladbach
Country:	Germany
Laboratory:	
	FCC Registration Number: 699717
	This site has been fully described in a report submitted to the FCC, and
	accepted in the letter dated Registration Number 699717.
Phone:	+49-2207-9689-0
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1.4 Manufacturer

Company Name:	TeraTron GmbH
Street:	Robert-Wilhelm-Bunsen-Strasse 5
City:	D-51647 Gummersbach
Country:	Germany

Name for contact purposes: Rainer Helberg

Phone:	+49(0) 22 61 / 8082-0
Fax:	+49(0) 22 61 / 8082-??
Mail:	rainer.helberg@teratron.de

1.5 Dates

Date of receipt of EUT:	2002 March 18
Test date:	2002 March 19

2 PRODUCT DESCRIPTION

2.1 Equipment Under Test (EUT)

Device:	**Transceiver**
Trade Name:	HILTI DSS
Model:	00160204 Operating Key
Serial Number:	none (Prototype)
FCC ID:	**QLXTPS-K**
Power:	3.0 VDC
Transmit Frequency:	434.910 MHz
Type of modulation:	A1D (ASK)
Interface:	none
Variants:	
Highest frequency generated or used in the device:	Q1 : 433.92 MHz / Q2 : 3.58 MHz

2.2 EUT Peripherals

The EUT were tested as stand-alone device.

2.3 Mode of Operation During Testing

The 00160204 Operating Key was tested in a typical fashion.. During preliminary emission tests the 00160204 Operating Key was operated in continuous TRANSMITTING and READING mode for worst case emission mode investigation. Therefore, final qualification testing was completed with 00160204 Operating Key operated in the both continuous modes. All tests performed with applicant typical voltage (3.0 Volts DC Lithium Battery).

2.4 Modifications Required for Compliance

None.

3 TEST RESULTS SUMMARY

Summary of Test Results Transmitter

Requirement	CFR Section	Report Section	Test Result
Antenna Requirement	15.203	4	Pass
Radiated Spurious Emissions	15.209, 15.205(b)	5	Pass
Conducted Emissions	15.207	6	*
Periodic Operation Characteristics	15.231 (a)	7	Pass
Field Strength Limits (Fundamental)	15.231 (b)	5	Pass
20 dB Bandwidth	15.231 (c)	9	Pass

* Not required, the EUT is battery powered.

The client has made the determination that EUT Condition, Characterization, and Mode of Operation are representative of production units, and meet the requirem'ents of the specifications referenced herein.

Consistent with Industry practice, measurement and test equipment not directly involved in obtaining measurement results but having an impact on measurements (such as cable loss, antenna factors, etc.) are factored into the "Correction Factor" documented in certain test results. Instrumentation employed for testing meets tolerances consistent with known Industry Standards and Regulations.

The measurements contained in this report were made in accordance with the procedure ANSI C63.4 1992 and all applicable Public Notices received prior to the date of testing. All emissions from the device were found to be within the limits outlined in this report. The test results in this report apply only to the particular Equipment Under Test (EUT) as declared in this report.

Test Personnel: Ralf Trepper
Issuance Date: 2002 March 19

4 ANTENNA REQUIREMENT

Test Requirement: FCC CFR47, Part 15C

4.1 Regulation

15.203 An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of Part 15C. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31 (d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

4.2 Result

Device: **DSS Anti-theft device**
Transmitter Model: 00160204 Operating Key

Antenna is a trace on the PCB.
The EUT meets the requirements of this section.

5 RADIATED EMISSIONS

Test Requirement: FCC CFR47, Part 15C Test Procedure: ANSI C63.4:1992

5.1 Regulation

15.231 (b) In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66 - 40.70	2,250	225
70-130	1,250	125
130-174	1,250 to 3,750	125 to 375
174-260	3,750	375
260-470	3,750 to 12,500	375 to 1,250
Above 470	12,500	1,250

** Linear interpolations

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, µV/m at 3 meters = 56.81818(F) - 6136.3636; for the band 260-470 MHz, µV/m at 3 meters = 41.6667(F) - 7083.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

(1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

(2) Intentional radiators operating under the provisions of this Section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. lf average emission measurements are employed, the provisions in Section 15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of Section 15.205 shall be demonstrated using the measurement instrumentation specified in that section.

(3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in Section 15.209, whichever limit permits a higher field strength

Section 15.33 Frequency range of radiated measurements: (a) Unless otherwise noted in the specific rule section under which the equipment operates for an intentional radiator the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in this paragraph: (1) lf the intentional radiator operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

5.2 Test Equipment

Type	Manufacturer/ Model No.	Serial No.	Last Calibration	Next Calibration
Receiver (9 kHz –30 MHz)	Anritzu Spectrum Analyzer MS 2601 (2)	MT74457	03/2002	03/2005
Receiver (9 kHz –30 MHz)	Rohde & Schwarz ESH2 (22)	882902/007	01/2002	01/2005
Loop Antenna	Schwarzbeck FMZB 1516			

5.3 Test Procedures

For tabletop equipment, the EUT is placed on a 1 meter by 1.5 meters wide and 0.8 meter high nonconductive table that sits on a flush mounted metal turntable. Floor standing equipment is placed directly on the flush mounted metal tumtable *[Remark: Not applicable]*. The EUT is connected to its associated peripherals with any excess I/0 cabling bundled to approximately 1 meter *[Remark: Not applicable]*.

Preview tests are performed to determine the "worst case" mode of operation. With the EUT operating in "worst case" mode, emissions from the unit are maximized by adjusting the polarization and height of the receive antenna and rotating the EUT on the turntable. Manipulating the system cables also maximizes EUT emissions *[Remark.Not applicable]*. *All* tests performed with the EUT placed in two polarizations on the nonconductive table: horizontal and vertical. Refer to the photographs'section.

Radiated Ernissions Test Characteristics	
Frequency range	30 MHz - 4,000 MHz
Test distance	3 m*
Test instrumentation resolution bandwidth	120 kHz (30 MHz - 1,000 MHz)
	1 MHz (1000 MHz - 4,000 MHz)
Receive antenna scan height	1 m - 4 m
Receive antenna polarization	Vertical/Horizontal

* According to Section 15.31 (f)(1): At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-Iinear-distance-squared for power density measurements).

5.4 Calculation of Field Strength Limits

Fundamental field strength limits for the band 260 - 470 MHz: µV/m at 3 meters = 41.6667(F[MHz]) - 7083.3333 = 41.6667* 315 - 7083.3333 = 6,041.68 6,041.68 µV/m corresponds with 75.6 dBµV/m. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level, i.e. 55.6 dBµV/m.

5.5 Calculation of Average Correction Factor

The average correction factor is computed by analyzing the "worst case" on time in any 100 msec time period and using the formula: Corrections Factor (c113) + 20*Iog (worst case on time/100 msec) Analysis of the remote transmitter worst case on time in any 100 msec time period is an on time of 50 msec, therefor the correction factor is 20*Iog (50/100) = - 6 dB. The maximum correction factor to be applied is 20 dB per section 15.35 of the FCC rules. *The relationship between average and peak mode reading has been confirmed also by direct measurement using the receiver's average and peak detectors. All emission measurements performed using the test receiver's peak detector and the max. hold facility; i. e. the peak value measured directly without the necessity of additional correction factor.*

5.6 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor. The basic equation with a sample calculation is as follows:

FS=RA+ AF+CF where FS Field Strength in dBµV/m RA Receiver Amplitude in dBµV AF Antenna Factor in dB(1/m) CF Cable Attenuation Factor in dB

Assume a receiver reading of 23.5 dBµV is obtained. The Antenna Factor of 7.4 dB(1/m) and a Cable Factor of 1.1 dB are added, giving a field strength of 32 dBµV/m. The 32 dBµV/m value can be mathematically converted to its corresponding level in µV/m.

FS = 23.5 + 7.4 + 1.1 = 32 [dBµV/m]

Level in µV/m = Common Antilogarithm (32/20) = 39.8

For test distance other than what is specified, but fulfilling the requirements of Section 15.31 (f)(1) the field strength is calculated by adding additionally an extrapolation factor of 20 dB/decade (inverse lineardistance for field strength measurements). The basic equation with a sample calculation is as follows:

FS=**RA**+ **AF**+**CF**+**DF** where

FS Field Strength in dBµV/m
RA Receiver Amplitude in dBµV **AF** Antenna Factor in dB(1/m) **CF** Cable Attenuation Factor in dB **DF** Distance Extrapolation Factor in dB, where DF = 20 log (Dtest/Dspec) where Dtest = Test Distance and Dspec = Specified Distance

Assume the tests performed at a reduced Test Distance of 1,5 m instead of the Specified Distance of 3 m giving a Distance Extrapolation Factor of DF = 20 log(1,5m/3m) = -6 dB. Assuming a receiver reading of 23.5 dBµV is obtained. The Antenna Factor of 7.4 dB(1/m), the Cable Factor of 1.1 dB and the Distance Factor of -6 dB are added, giving a field strength of 26 dBµV/m. The 26 dBµV/m value can be mathematically converted to its corresponding level in µV/m.

FS = 23.5 + 7.4 + 1.1 - 6 = 26 [dBµV/m]

Level in µV/m = Common Antilogarithm (26/20) = 20

5.7 Test Results

5.7.1 Model 00160204 Operating Key

PRODUCT EMISSIONS PEAK DATA 15.231 BANDS											
No	Emission Frequency [MHz]	Receiver Mode and Bandwidth [kHz]	Test Distance [m]	Receiver Reading RA [dBµV]	Correction Factor AF+CF [dB(1/m)]	Distance Extrapola-tion Factor DF [dB]	Result = Corrected Reading FS [dBµV/m]	Spec Limit [dBµV/m]	Antenna Height [cm]	Polarization Eut/Ant	Margin [dB]
1	433.910	120, PK	3	47.4	24.0	0	71.4	80.8	180	V/V	9.4
2	867.820	120, PK	3	11.7	31.6	0	43.3	60.8	240	V/V	17.5
3	1301.730	1000, PK	3	< 10	28.5	0	38.5*[2]	60.8	100-400	H, V/H, V	22.3
4	1735.730	1000, PK	3	< 10	28.6	0	38.6*[2]	60.8	100-400	H, V/H, V	22.2
5	2169.640	1000, PK	3	< 17	29.0	0	46.0*[2]	60.8	100-400	H, V/H, V	14.8
6	2603.550	1000, PK	3	< 17	29.3	0	46.3*[3]	60.8	100-400	H, V/H, V	14.5
7	3037.460	1000, PK	3	< 17	30.6	0	47.6*[3]	60.8	100-400	H, V/H, V	13.2
8	3471.370	1000, PK	3	< 17	31.4	0	48.4*[3]	60.8	100-400	H, V/H, V	12.4
9	3905.280	1000, PK	3	< 17	31.6	0	48.6*[3]	60.8	100-400	H, V/H, V	12.2
10	4339.190	1000, PK	3	< 17	32.5	0	49.5*[3]	60.8	100-400	H, V/H, V	11.3

PRODUCT EMISSIONS PEAK DATA 15.205 BANDS											
No	Emission Frequency [MHz]	Receiver Mode and Bandwidth [kHz]	Test Distance [m]	Receiver Reading RA [dBµV]	Correction Factor AF+CF [dB(1/m)]	Distance Extrapola-tion Factor DF [dB]	Result = Con-ected Reading FS [dBµV/m]	Spec Limit [dBµV/m]	Antenna Height [cm]	Polarization Eut/Ant	Margin [dB]
1	30	QP, 120	3	< 6.5	-2.9	0	3.6*[1]	40.0	100-400	V, H/V, H	33.4
2	88	QP, 120	3	< 6.5	-11.2	0	-4.7*[1]	42.0	100-400	V, H/V, H	46.7
3	216	QP, 120	3	< 6.5	-9.2	0	-2.7*[1]	51.4	100-400	V, H/V, H	54.1
4	960	QP, 120	3	< 6.5	12.6	0	19.1*[1]	61.9	100-400	V, H/V, H	42.8
5	1000	AV, 1000	3	< 10	29.6	0	39.6*[2]	61.9	100-400	V, H/V, H	22.3
6	1500	AV, 1000	3	< 10	28.4	0	38.4*[2]	61.9	100-400	V, H/V, H	23.5
7	2000	AV, 1000	3	< 10	28.8	0	38.8*[2]	61.9	100-400	V, H/V, H	23.1
In this band no emissions detected											

Remark: *[1] noise floor noise level of the measuring instrument ≤ 6.5dBµV @ 3m distance (30 – 1000 MHz)
Remark: *[2] noise floor noise level of the measuring instrument ≤ 10 dBµV @ 3m distance (1000 – 2000 MHz)
Remark: *[3] noise floor noise level of the measuring instrument ≤ 17 dBµV @ 3m distance (2000 – 5500 MHz)
The EUT meets the requirements of this section.

Test Personnel: Ralf Trepper
Issuance Date: 2002 March 19

6 CONDUCTED EMISSIONS TESTS

Test Requirement: FCC CFR47, Part 15C
Test Procedure: ANSI C63.4:1992

6.1 Regulation

Section 15.207 (a) For an intentional radiator which 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 450 kHz to 30 MHz shall not exceed 250 microvolts. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line

and ground at the power terminals.

Section 15.207 (d) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which-do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provision for, the use of battery chargers which permit operating while charging, AC adaptors or

battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the

conducted limits.

6.2 Test Equipment

Not applicable.

6.3 Test Procedures

Not applicable.

6.4 Test Results

Device: DSS Anti-theft device Transmitter Model: 00160204 Operating Key

The EUT is battery powered only. Therefore - according to Section 15.207

(d) - conducted emissions measurements to demonstrate compliance with the conducted limits are not required.

7 PERIODIC OPERATION CHARACTERISTICS

Test Requirement: FCC CFR47, Part 15C

7.1 Periodic Operation

7.1.1 Regulation

15.231 (a) The provisions of this Section are restricted to periodic operation within the band 40.66 40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this Section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Radio control of toys is not permitted. Continuous transmissions, such as voice or video, and data transmissions are not permitted. The prohibition against data transmissions does not preclude the use of recognition codes. Those codes are used to identify the sensor that is activated or to identify the particular component as being part of the system.

7.1.2 Result

Device: DSS Anti-theft device
Transmitter Model: 00160204 Operating Key

The EUT meets the requirements of this section.

7.2 Manually Operated Transmitter Deactivation

7.2.1 Regulation

15.231 (a1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

7.2.2 Result

Device: DSS Anti-theft device
Transmitter Model: 00160204 Operating Key

Transmitter ceases immediately after being released.

The EUT meets the requirements of this section.

7.3 Automatically Operated Transmitter Deactivation

7.3.1 Regulation

15.231 (a2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

7.3.2 Result

Device: DSS Anti-theft device
Transmitter Model: 00160204 Operating Key

The EUT does not have automatic transmission.

7.4 Prohibition of Periodic Transmission

7.4.1 Regulation

15.231 (a3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions to determine systern integrity of transmitters used in security or safety applications are allowed if the periodic rate of transmission does not exceed one transmission of not more than one second duration per hour for each transmitter.

7.4.2 Result

Device: DSS Anti-theft device
Transmitter Model: 00160204 Operating Key

The EUT does not employ periodic transmission.

7.5 Continuous Transmission During an Alarm Condition

7.5.1 Regulation

15.231 (a4) Intentional radiators which are employed for radio control purposes during ernergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.

7.5.2 Result

Device: DSS Anti-theft device
Transmitter Model: 00160204 Operating Key

This section is not applicable to the EUT.

8 BANDWIDTH

Test Requirement: FCC CFR47, Part 15C

Test Procedure: ANSI C63.4:1992 Section 13.1.7

8.1 Regulation

15.231 (c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

8.2 Calculation of 20 dB Bandwidth Limit

The 20 dB bandwidth limit = 0.0025 * 433.91 MHz = 1.0847 MHz = 1084.7 kHz

8.3 Test Equipment

Type	Manufacturer/ Model No.	Serial No.	Last Calibration	Next Calibration
Receiver	Hewlett Packard Spectrum Analyzer (171)	3528U00990	02/2002	02/2004
(30MHz - 1GHz)	8593 E			
Pre-Amplifiere	Hewlett Packard			
(30MHz - 1GHz	8447 E (166a)	1726°00705	04/2002	04/2006
Antenna	Chase (Bilog)	1517	04/2002	04/2008
(30 MHz - 1 GHz)	CBL 611A			
Receiver (1 GHz - 26.5 GHz)	Hewlett Packard Spectrum Analyzer (171) 8593 E	3528U00990	02/2002	02/2004
Antenna	Schwarzbeck			

8.4 Test Procedure

ANSI C63.4-1992 Section 13.1.7 Occupied Bandwidth Measurements. The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at either the fundamental frequency or first-order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical. Once the reference level is established, the equipment is conditioned with typical modulating signals to produce worst-case (i.e., the widest) bandwidth. In order to measure the modulated signal properly, a resolution bandwidth that is small compared to the bandwidth required by the procuring or regulatory agency shall be used on the measuring instrument. However, the 6 dB resolution bandwidth of the measuring instrument shall be set to a value greater than 5% of the bandwidth requirements.

8.5 Test Result

8.5.1 Model : 00160204 Operating Key

Bandwidth setting of the analyzer: ..... 30 kHz [3 dB] corresponds with 46 kHz [6 dB]

The measured 20 dB bandwidth is: ..... **9.80 kHz**

The EUT meets the requirements of this section.

Test Personnel: Ralf Trepper
Issuance Date: 2002 March 19

9 PHOTOGRAPHS OF THE TEST SETUP

9.1 Radiated Ernissions Tests

9.1.2 Photograph: EUT in horizontal polarization on the turntable

9.2 Conducted Emission Tests

not applicable

10 MISCELLANEOUS COMMENTS AND NOTES

None.

11 LIST OF ANNEXES

The following Exhibits are separated annexes to this test report.

Annex No.	Exhibit	Pages
1	External Photographs of the Equipment Under Test	2
2	Intemal Photographs of the Equipment Under Test	2
3	Occupied Bandwith Plot	1
4	FCC ID Label Sample	2
5	Technical Description /Operational Description	13
6	Test Setup Foto	1
7	Block Diagram	1
8	Schematics	4
9	Letter of Confidentiality	1