FCC ID: CB2R171HL3

Deutscher Akkreditierungs Rat

DAT - P-011 / 91-02
TTI - P-G 089 / 94-11

E M I S S I O N -- T E S T R E P O R T

Test Report File No.	:	**T23230-00-00KJ**	Date of issue	: April 22, 2003

Type Designation	:	R171 (HomeLink 3)
Kind of Product	:	Universal Garage Door Opener
Applicant	:	Johnson Controls Interiors L.L.C.
Manufacturer	:	Johnson Controls GmbH
Licence holder	:	Johnson Controls Interiors L.L.C.
Address	:	One Prince Center
		Holland, Michigan 49423, USA

Test result accdg. to the regulation(s) at page 3	:	**Positive**

This test report with attachment consists of **54** pages.
The test result only corresponds to the tested sample. It is not permitted to copy this report, in part or in full, without the permission of the test laboratory.

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D I R E C T O R Y

MIKES BABT PRODUCT SERVICE GmbH Ohmstrasse 2-4 94342 Strasskirchen Tel.:+9424-9407-0 Fax:+9424-9407-60 Rev. No. 9.2

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T E S T R E G U L A T I O N S

The tests were performed according to following regulations :

o - EN 50081-1 / 2.1991
o - EN 50081-2 / 7.1993

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o - EN 55011 / 3.1991 o - Group 1 o - Group 2
o - class A o - class B

o - EN 55014 / 4.1993 o - Household appliances and similar
o - tools
o - Semiconductor devices

o - EN 55014 / A2:1990
o - EN 55104 / 5.1995 Category:

o - EN 55015 / A1:1990
o - EN 55015 / 12.1993

o - EN 55022 / 5.1995 o - class A o - class B

o - prEN 55103-1 / 3.1995
o - prEN 50121-3-2 / 3.1995
o - EN 60601-1-2 / 4.1994

o - VCCI o - class 1 o - class 2

o - Part 15 Subpart C (15.209)
■ - Part 15 Subpart C (15.231)

ADDRESS OF THE TEST LABORATORY

■ - **MIKES BABT PRODUCT SERVICE GmbH**
Ohmstrasse 2-4
D - 94342 Strasskirchen

o - _____
_____
_____
_____

ENVIRONMENTAL CONDITIONS

Temperature:	15-35 ° C
Humidity	45-60 %
Atmospheric pressure	860-1060 mbar

POWER SUPPLY SYSTEM UTILIZED

Power supply system	o 230V/50 Hz / 1ϕ	■ 12 V DC
	o 400V/50 Hz 3PE	o 400V/50 Hz 3NPE

STATEMENT OF MEASUREMENT UNCERTAINTY

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report accdg. to NIS 81 /5.1994 „The Treatment of Uncertainty in EMC Measurements“ and is documented in the MIKES BABT Product Service quality system accdg. to EN 45001. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

SHORT DESCRIPTION OF THE EQUIPMENT UNDER TEST (EuT)

The EuT is an Universal Garage Door Opener. That is installed into an overhead console of the automobile. The Universal Garage Door Opener has the capability to:

- Learn the frequency and bit code format of the user´s existing garage door remote control device and
- Reproduce and transmitt the frequency and bit code format to remotely operate the user´s garage door.

Number of received/tested samples:	**2/1**
Serial Number:	Prototype

DEFINITIONS FOR SYMBOLS USED IN THIS TEST REPORT

■ The black square indicates that the listed condition, standard or equipment is applicable for this report.

o Blank box indicates that the listed condition, standard or equipment was not applicable for this report.

M E A S U R E M E N T P R O T O C O L F O R F C C , V C C I A N D A U S T E L

Test Methodology

Conducted and radiated emission testing is performed according to the procedures in International Special Committee on Radio Interference (CISPR) Publication 22 (1993), European Standard EN 55022 and Australian Standard AS 3548 (which are based on CISPR 22).

The Japanese standard, "Voluntary Control Council for Interference (VCCI) by Data Processing Equipment and Electronic Office Machines, Technical Requirements" is technically equivalent to CISPR 22 (1993). For official compliance, a conformance report must be sent to and accepted by the VCCI.

In compliance with FCC Docket 92-152, "Harmonization of Rules for Digital Devices Incorporate International Standards", testing for FCC compliance may be done following the ANSI C63.4-1992 procedures and using the FCC limits or the CISPR 22 Limits.

Measurement Uncertainty

The test system for conducted emissions is defined as the LISN, tuned receiver or spectrum analyzer, and coaxial cable. The test system for radiated emissions is defined as the antenna, the pre-amplifier, the spectrum analyzer and the coaxial cable. These test systems have a measurement uncertainty of ±4.5 dB. The equipment comprising the test systems are calibrated on an annual basis.

Justification

The Equipment Under Test (EuT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral into it’s characteristic impedance or left unterminated. When appropriate, the cables are manually manipulated with respect to each other to obtain maximum emissions from the unit.

General Standard Information

The test methods used comply with CISPR Publication 22 (1993), EN 55022 (1987) and AS 3548 (1992) - "Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment" and with ANSI C63.4-1992 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."

For detailed description of each measurement please refer to section test results.

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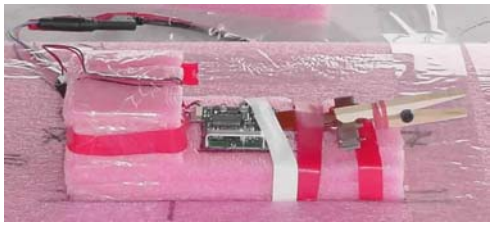
DISCOVERY OF WORST CASE MEASUREMENT CONDITION:

The Universal Garage Door Opener R171 is designed for the operation in the frequency range of 288 MHz to 420 MHz.

The final measurements were made at a low band frequency (288 MHz), a mid band frequency (310 MHz), and a high band frequency (418 MHz). At each frequency the EuT was placed in three orthogonal positions. At each psition a 500 Hz puzlse modulation was adjusted to a 30%, 50%, and 80% duty cycle. At each duty cycle, measurements were taken with the receive antenna in vertical and horizontal positions.

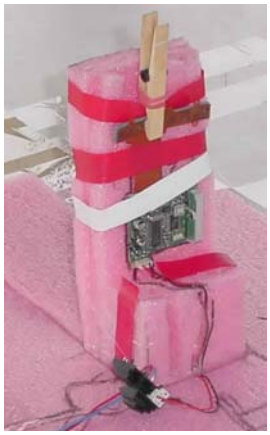
The orthogonal positions are:

Flat



Side

End



- The transmit PCB was removed from the housing for this evaluation.
- Measurement of the radiated fieldstrength of the operating frequency measured in permanent operation mode in the specified channel. This measurement have been performed in order to find out the maximum transmitted fieldstrength of the Universal Garage Door Opener.
- Measurement of the radiated spurious emissions measured in permanent operation mode in the specified channel. This measurement have been performed in order to find out the maximum spurious emissions of the Universal Garage Door Opener.

T E S T R E S U L T

CONDUCTED EMISSIONS - 10/150 kHz - 30 MHz

■ **- Test not applicable**

Test location :

o - Shielded room no. 1
o - Shielded room no. 2
o - Shielded room no. 3
o - Shielded room no. 4
o - Shielded room no. 5
o - Shielded room no. 6
o - Shielded room no. 7
o - Anechoic chamber
o - Full compact chamber

For test instruments and test accessories used please see attachment B A4

Description of Measurement

The final level, expressed in dBμV, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the FCC Limit or to the CISPR limit, which is equivalent to the Australian AS 3548 limit.

To convert between dBμV and μV, the following conversions apply:
dBμV = 20(log μV)
μV = Inverse log(dBμV/20)

Conducted emissions on the 50 Hz and/or 60 Hz power interface of the EuT are measured in the frequency range of 150 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection, and a Line Impedance Stabilization Network (LISN), with 50Ω/50 μH (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimeter's above the floor and is positioned 40 centimeter's from the vertical ground plane (wall) of the screen room. If the minimum passing margin appears to be less than 20 dB with a peak mode measurement, the emissions are remeasured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

Test result:

The requirements are **o - MET** **o - NOT MET**

Min. limit margin _____ dB at _____ MHz

Max. limit exceeding _____ dB at _____ MHz

Remarks: Not applicable.

SPURIOUS EMISSION

Spurious emissions from the EuT are measured in the frequency range of 9 kHz to 30 MHz using a tuned receiver and a shielded loop antenna. The antenna was positioned 3, 10 or 30 meters horizontally from the EuT. Measurements have been made in all three orthogonal axes and the shielded loop antenna was rotated to locate the maximum of the emissions.

Spurious emissions from the EuT are measured in the frequency range of 30 MHz to 10 times the highest used frequency using a tuned receiver and appropriate broadband linearly polarized antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection and measurements above 1000 MHz are made with a 1 MHz/6 dB bandwidth and peak detection, remeasurement of results which may be critical will be repeated in average mode. Table top equipment is placed on a 1.0 X 1.5 meter non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. Interface cables that are closer than 40 centimetres to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screen room located outside the test area. The antenna was positioned 3, 10 or 30 meters horizontally from the EuT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 meters, measurement scans are made with both horizontal and vertical antenna polarization`s and the EuT are rotated 360 degrees.

SPURIOUS EMISSION (MAGNETIC FIELD) 9 kHz - 30 MHz

■ **- Test not applicable**

o - in a shielded room
o - at a non - reflecting open-site
and
o - in a test distance of 3 meters.
o - in a test distance of 30 meters.

For test instruments and test accessories used please see attachment B SER1

Description of Measurement

The final level, expressed in dBµV/m, is arrived at by taking the reading from the EMI receiver (Level dBµV) and adding the antenna correction factor and cable loss factor (Factor dB) to it. This result then has to be compared with the relevant FCC limit.
The resolution bandwidth during the measurement is as follows:
9 kHz – 150 kHz: ResBW: 200 Hz
150 kHz – 30 MHz: ResBW: 10 kHz

Example:

Frequency (MHz)	Level (dBµV)	+	Factor (dB)	=	Level (dBµV/m)	Limit (dBµV/m)	=	Delta (dB)
1.705	5	+	20	=	25	30	=	5

Testresult in detail:

Frequency [MHz]	L: PK [dBµV]	L: AV [dBµV]	L: QP [dBµV]	Correct. [dB]	L: PK [dBµV/m]	L: AV [dBµV/m]	L: QP [dBµV/m]	Limit [dBµV/m]

The requirements are **o - MET** **o - NOT MET**

Min. limit margin _____ dB at _____ MHz

Max. limit exceeding _____ dB at _____ MHz

Remarks: Not applicable.

SPURIOUS EMISSIONS (electric field) 30 MHz - 1000 MHz

o **- Test not applicable**

Test location :

■ - Open-site 1
o - Open-site 2
■ - 3 meters
o - 10 meters
o - 30 meters

For test instruments and test accessories used please see attachment B SER2

Description of Measurement

The final level, expressed in dBµV/m, is arrived by taking the reading from the EMI receiver (Level dBµV) and adding the correction factors and cable loss factor (Factor dB) to it. This is done automatically in the EMI receiver, where the correction factors are stored. This result then has the FCC or CISPR limit subtracted from it to provide the Delta which gives the tabular data as shown in the data sheets at page 24 - 25. The CISPR 22 limit is equivalent to the Australian AS 3548 limit.

Example:

Frequency (MHz)	Level (dBµV)	+	Factor (dB)	=	Level (dBµV/m)	Limit (dBµV/m)	=	Delta (dB)
719	75	+	32.6	=	107.6	110	=	-2.4

Example of duty cycle calculation:

$$\text{Duty Cycle Factor [dB]} = 20 * \log \frac{\text{duty cycle [\%]}}{100\,[\%]} \quad = \quad -10.46\ \text{dB} = 20 * \log \frac{30\,[\%]}{100\,[\%]}$$

Testresult in detail:

EuT tuned to transmit at 288 MHz

Frequency [MHz]	EuT position	Ant. pol.	L: PK [dBµV]	Duty cycle [%]	Duty cycle Factor [dB]	Correct. [dB]	Calculated level [dBµV/m]	FCC limit [dBµV/m]	Margin [dB]
575.9	flat	H	36.0	30	-10.46	28.1	53.64	53.8	0.16
575.9	end	V	26.9	50	-6.02	28.1	48.98	53.8	4.82
575.9	flat	V	21.7	80	-1.94	28.1	47.86	53.8	5.94
863.8	end	H	10.5	30	-10.46	32.4	32.44	53.8	21.36
863.8	side	H	5.7	50	-6.02	32.4	32.08	53.8	21.72
863.8	end	V	4.3	80	-1.94	32.4	34.76	53.8	19.04

EuT tuned to transmit at 310 MHz

Frequency [MHz]	EuT position	Ant. pol.	L: PK [dBµV]	Duty cycle [%]	Duty cycle Factor [dB]	Correct. [dB]	Calculated level [dBµV/m]	FCC limit [dBµV/m]	Margin [dB]
619.8	flat	H	29.9	30	-10.46	28.7	48.14	55.3	7.16
619.8	flat	H	22.7	50	-6.02	28.7	45.38	55.3	9.92
619.8	flat	H	18.2	80	-1.94	28.7	44.96	55.3	10.34
929.7	side	H	11.3	30	-10.46	35.3	36.14	55.3	19.16
929.7	flat	H	4.8	50	-6.02	35.3	34.08	55.3	21.22
929.7	-	-	-	80	-1.94	-35.3	-	55.3	-

EuT tuned to transmit at 418 MHz

Frequency [MHz]	EuT position	Ant. pol.	L: PK [dBµV]	Duty cycle [%]	Duty cycle Factor [dB]	Correct. [dB]	Calculated average level [dBµV/m]	FCC limit [dBµV/m]	Margin [dB]
835.8	flat	H	27.0	30	-10.46	31.1	47.64	60.3	12.66
835.8	side	H	19.0	50	-6.02	31.1	44.08	60.3	16.22
835.8	flat	H	10.8	80	-1.94	31.1	39.96	60.3	20.34

Testresult

The requirements are ■ - MET o - NOT MET

Min. limit margin 0.16 dB at 575.9 MHz

Max. limit exceeding _____ dB at _____ MHz

Remarks: The limits are kept.

SPURIOUS EMISSION 1 GHz - 18 GHz

o **- Test not applicable**

Testlocation :

o - Open-site 1
o - Open-site 2
■ - Anechoic chamber
o - Full compact chamber

o - 1 meters
■ - 3 meters
o - 10 meters

For test instruments and test accessories used please see attachment B SER3

Description of Measurement

The final level, expressed in dBµV/m, is arrived by taking the reading from the Spectrumanalyzer in dBµV and adding the correction factors of the test setup incl. cables.

Example of the correction value at 1.8 GHz

Level reading at 1.8 GHz	Correction EMCO 3115	correction Amplifier AWT 4534 + cable	Correction factor (summarized)	corrected level
56 dBµV	+27.3 dB	-41.2 dB	-15.8 dB	42.1 dBµV/m

Example of duty cycle calculation:

$$\text{Duty Cycle Factor [dB]} = 20 * \log \frac{\text{duty cycle [\%]}}{100\,[\%]} \quad = \quad -10.46\ \text{dB} = 20 * \log \frac{30\,[\%]}{100\,[\%]}$$

Testresult in detail:

EuT tuned to transmit at 288 MHz

Frequency [MHz]	EuT position	Ant. pol.	L: PK [dBµV]	Duty cycle [%]	Duty cycle Factor [dB]	Correct. [dB]	Calculated level [dBµV/m]	FCC limit [dBµV/m]	Margin [dB]
1152.8	flat	V	53.4	30	-10.46	-15.7	27.24	54.0	26.76
1152.8	flat	V	50.6	50	-6.02	-15.7	28.88	54.0	25.12
1152.8	-	-	-	80	-1.94	-15.7	-	54.0	-
1439.8	side	V	60.7	30	-10.46	-15.1	35.14	54.0	18.86
1439.8	flat	V	59.5	50	-6.02	-15.1	38.38	54.0	15.62
1439.8	flat	V	58.9	80	-1.94	-15.1	41.86	54.0	12.14
1727.6	side	H	55.5	30	-10.46	-13.8	31.24	53.8	22.56
1727.6	side	H	51.9	50	-6.02	-13.8	32.08	53.8	21.72
1727.6	side	H	52.0	80	-1.94	-13.8	36.26	53.8	17.54
2015.6	side	H	52.8	30	-10.46	-11.7	30.64	53.8	23.16
2015.6	-	-	-	50	-6.02	-11.7	-	53.8	-
2015.6	-	-	-	80	-1.94	-11.7	-	53.8	-

EuT tuned to transmit at 310 MHz

Frequency [MHz]	EuT position	Ant. pol.	L: PK [dBµV]	Duty cycle [%]	Duty cycle Factor [dB]	Correct. [dB]	Calculated level [dBµV/m]	FCC limit [dBµV/m]	Margin [dB]
1239.3	flat	V	52.7	30	-10.46	-15.4	26.84	54.0	27.16
1239.3	flat	V	49.1	50	-6.02	-15.4	27.68	54.0	26.32
1239.3	-	-	-	80	-1.94	-15.4	-	54.0	-
1549.2	flat	V	62.3	30	-10.46	-14.8	37.04	54.0	16.96
1549.2	flat	V	60.2	50	-6.02	-14.8	39.38	54.0	14.62
1549.2	flat	V	59.1	80	-1.94	-14.8	42.36	54.0	11.64
1858.9	side	H	52.7	30	-10.46	-12.9	29.34	55.3	25.96
1858.9	-	-	-	50	-6.02	-12.9	-	55.3	-
1858.9	-	-	-	80	-1.94	-12.9	-	55.3	-
2168.8	side	H	50.6	30	-10.46	-11.3	28.84	55.3	26.46
2168.8	-	-	-	50	-6.02	-11.3	-	55.3	-
2168.8	-	-	-	80	-1.94	-11.3	-	55.3	-

EuT tuned to transmit at 418 MHz

Frequency [MHz]	EuT position	Ant. pol.	L: PK [dBµV]	Duty cycle [%]	Duty cycle Factor [dB]	Correct. [dB]	Calculated level [dBµV/m]	FCC limit [dBµV/m]	Margin [dB]
1253.5	end	V	54.7	30	-10.46	-15.4	28.84	60.3	31.46
1253.5	flat	V	54.0	50	-6.02	-15.4	32.58	60.3	27.72
1253.5	flat	V	54.8	80	-1.94	-15.4	37.46	60.3	22.84
1671.5	end	V	54.9	30	-10.46	-14.2	44.44	54.0	9.56
1671.5	side	V	52.8	50	-6.02	-14.2	46.78	54.0	7.22
1671.5	flat	V	53.8	80	-1.94	-14.2	37.66	54.0	16.34
2089.3	site	H	51.7	30	-10.46	-11.6	29.64	60.3	30.66
2089.3	site	H	50.6	50	-6.02	-11.6	32.98	60.3	27.32
2089.3	end	V	49.6	80	-1.94	-11.6	36.06	60.3	24.24

Testresult

The requirements are ■ - MET o - NOT MET

Min. limit margin 7.22 dB at 1671.5 MHz

Max. limit exceeding _____ dB at _____ MHz

Remarks: The limits are kept.

The measurement was performed up to the 10th harmonic (4180 MHz)

FIELD STRENGTH OF THE FUNDAMENTAL WAVE

o **- Test not applicable**

■ - Open-site 1
o - Open-site 2
o - 3 meters
■ - 10 meters
o - 30 meters

For test instruments and test accessories used please see attachment B CPR2

Description of Measurement

The final level, expressed in dBµV/m, is arrived by taking the reading from the EMI receiver (Level dBµV) and adding the correction factors and cable loss factor (Factor dB) to it. This is done automatically in the EMI receiver, where the correction factors are stored. This result then has the FCC or CISPR limit subtracted from it to provide the Delta which gives the tabular data as shown in the data sheets at page 24 - 25. The CISPR 22 limit is equivalent to the Australian AS 3548 limit.

Example:

Frequency (MHz)	Level (dBµV)	+	Factor (dB)	=	Level (dBµV/m)	-	Limit (dBµV/m)	=	Delta (dB)
315	45	+	22.5	=	67.5	-	74.3	=	-6.8

Example of duty cycle calculation:

$$\text{Duty Cycle Factor [dB]} = 20 * \log \frac{\text{duty cycle [\%]}}{100\,[\%]} \quad = \quad -10.46\ \text{dB} = 20 * \log \frac{30\,[\%]}{100\,[\%]}$$

Testresult in detail:

EuT tuned to transmit at 288 MHz

Frequency [MHz]	Ant. pol.	L: PK [dBµV]	Duty cycle [%]	Duty cycle Factor [dB]	Correct. [dB]	Calculated level [dBµV/m]	FCC limit [dBµV/m]	Margin [dB]
288	V	46.6	30	-10.46	22.9	59.04	63.4	4.36
288	V	42.4	50	-6.02	22.9	59.28	63.4	4.12
288	V	36.3	80	-1.94	22.9	57.26	63.4	6.14

Testresult in detail:

EuT tuned to transmit at 310 MHz

Frequency [MHz]	Ant. pol.	L: PK [dBµV]	Duty cycle [%]	Duty cycle Factor [dB]	Correct. [dB]	Calculated level [dBµV/m]	FCC limit [dBµV/m]	Margin [dB]
310	V	53.8	30	-10.46	21.0	64.34	64.9	0.56
310	V	49.3	50	-6.02	21.0	64.28	64.9	0.62
310	V	44.5	80	-1.94	21.0	63.56	64.9	1.34

EuT tuned to transmit at 418 MHz

Frequency [MHz]	Ant. pol.	L: PK [dBµV]	Duty cycle [%]	Duty cycle Factor [dB]	Correct. [dB]	Calculated level [dBµV/m]	FCC limit [dBµV/m]	Margin [dB]
418	H	53.5	30	-10.46	25.7	68.74	69.8	1.06
418	H	48.1	50	-6.02	25.7	67.78	69.8	2.02
418	H	43.2	80	-1.94	25.7	66.96	69.8	2.84

Testresult

The requirements are ■ - MET o - NOT MET

Min. limit margin 0.56 dB at 310 MHz

Max. limit exceeding _____ dB at _____ MHz

Remarks: The limits are kept.

CONDUCTED POWER OF THE FUNDAMENTAL WAVE MEASURED ON THE ANTENNA TERMINALS

■ **- Test not applicable**

Testlocation :

o - Shielded room no. 1
o - Shielded room no. 2
o - Shielded room no. 3
o - Shielded room no. 4
o - Shielded room no. 5
o - Shielded room no. 6
o - Shielded room no. 7
o - Anechoic chamber
o - Full compact chamber
o - Climatic test chamber VLK

For test instruments and test accessories used please see attachment B CPC2

Description of Measurement

The conducted power of the fundamental wave measured on the antenna terminals in a climatic test chamber. The antenna jack was connected to the input of a communication test receiver. The internal batteries have been removed also and a variable DC power supply was used instead. The measurements have been made with the EuT unmodulated. During the test the supply voltage and the temperature were varied and applied simultaneously. The lower supply voltage was given by the manufacturer. In case the equipment was switching off before, the switch off voltage was used instead.

Testresult

The requirements are **o - MET** **o - NOT MET**

Frequency range of equipment								
Temperature °C	**DC supply voltage V**	**Power dBm**	**Power dBm**	**Power dBm**	**Power dBm**	**Power dBm**	**Power dBm**	**Power dBm**
-30								
-20								
-10								
0								
+10								
+20								
+30								
+40								
+50								

Remarks: Not applicable.

E Q U I P M E N T U N D E R T E S T

Operation - mode of the EuT.:

The equipment under test was operated during the measurement under following conditions:

o - Standby

o - Test program (H - Pattern)

o - Test program (colour bar)

o - Test program (customer specific)

■ - Continuous transmission on 288 MHz, 310 MHz, and 418 MHz with a modulation of 500 Hz pulse.

Configuration of the equipment under test: see attachment D

Following periphery devices and interface cables were connected during the measurement:

■	- DC Power Supply	Type : 3231-T25/E
o	-	Type :
o	-	Type :
o	-	Type :
o	-	Type :
o	-	Type :

■ - unshielded power cable

o - unshielded cables

o - shielded cables MBPS.No.:

■ - customer specific cables

o -

o -

FCC ID: CB2R171HL3

S U M M A R Y

GENERAL REMARKS:

The product Universal Garage Door Opener R171 has been tested on the following frequency:
TX-Mode: 288 MHz
310 MHz
418 MHz

The unit measurements met also the bandwidth requirements.

The EuT complies with the requirements described under 15.231(a) regarding the activation/deactivation of the transmitter. The transmitter on time is smaller than 5 seconds after activation.

FINAL JUDGEMENT:

The requirements according to the technical regulations and tested operation modes are

■ - met.

o - **not** met.

The Equipment Under Test

■ - **Fulfils** the general approval requirements according to page 3.

o - **Does not** fulfil the general approval requirements according to page 3.

Date of receipt of test sample : accdg. to storage record of MBPS

Testing Start Date : March 02, 2003

Testing End Date : March 11, 2003

Checked by:

i. A.

Günter Mikes
Dipl.Ing.(FH)

Tested by:

i.A.

Josef Knab

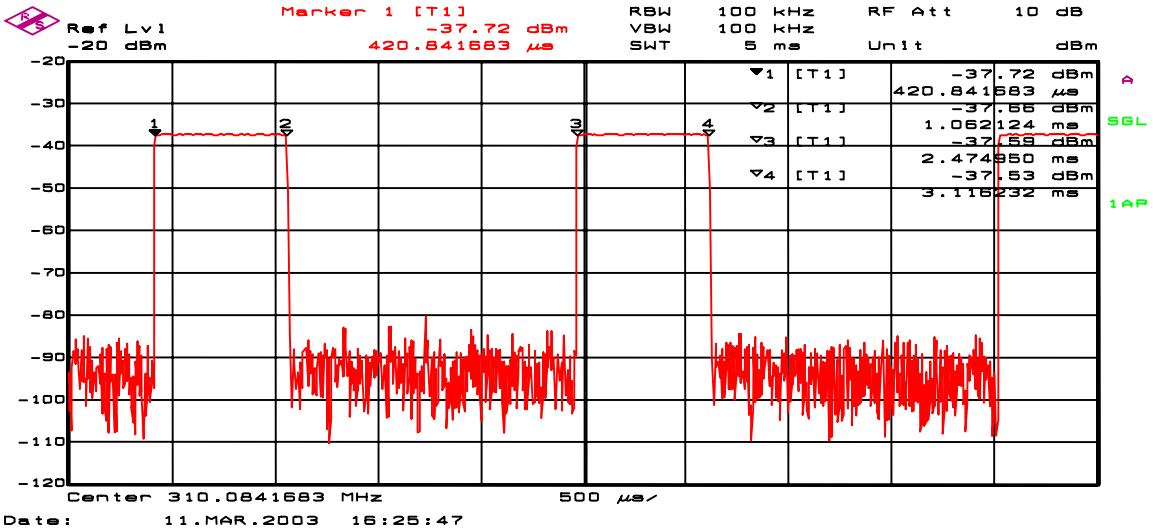
Attachment A: Test data

Modulation Characteristics

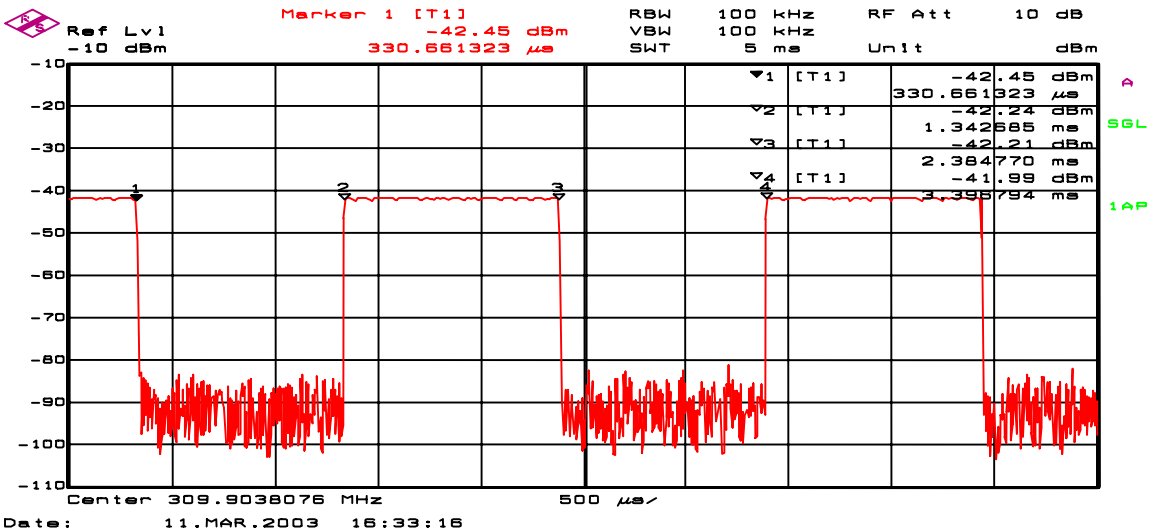
FCC Part 2.1033 (b6)

Typical encoded transmission at 310 MHz: Consisting of pulses of differing duty cycles.

310 MHz, 500 Hz Modulation, 30 % duty cylce



310 MHz, 500 Hz Modulation, 50 % duty cylce

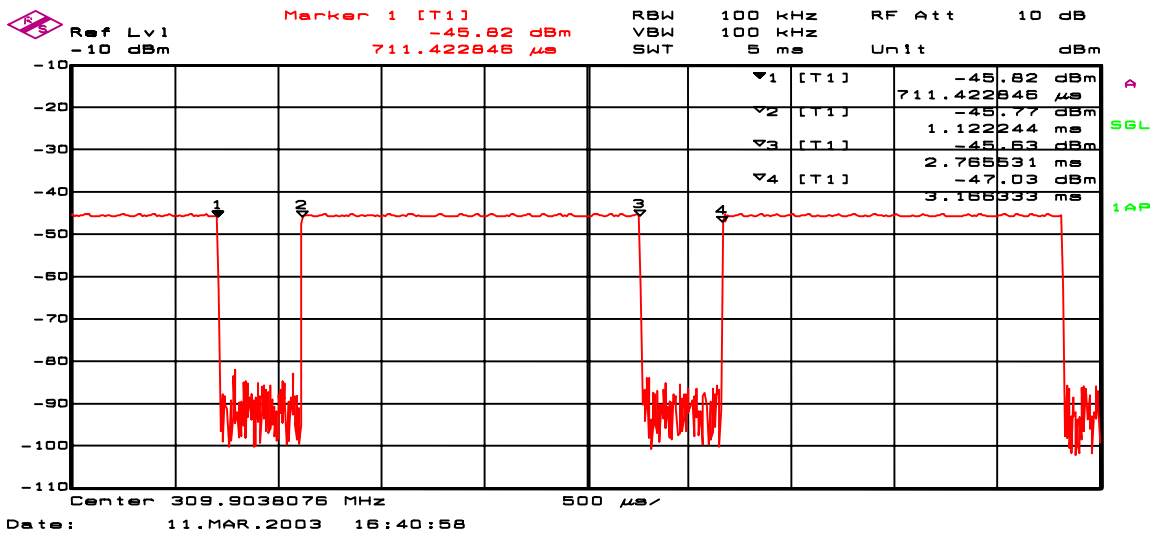


Attachment A: Test data

Modulation Characteristics

FCC Part 2.1033 (b6)

310 MHz, 500 Hz Modulation, 80 % duty cylce



Attachment A: Test data

Relative Emission Level vs. Supply Voltage

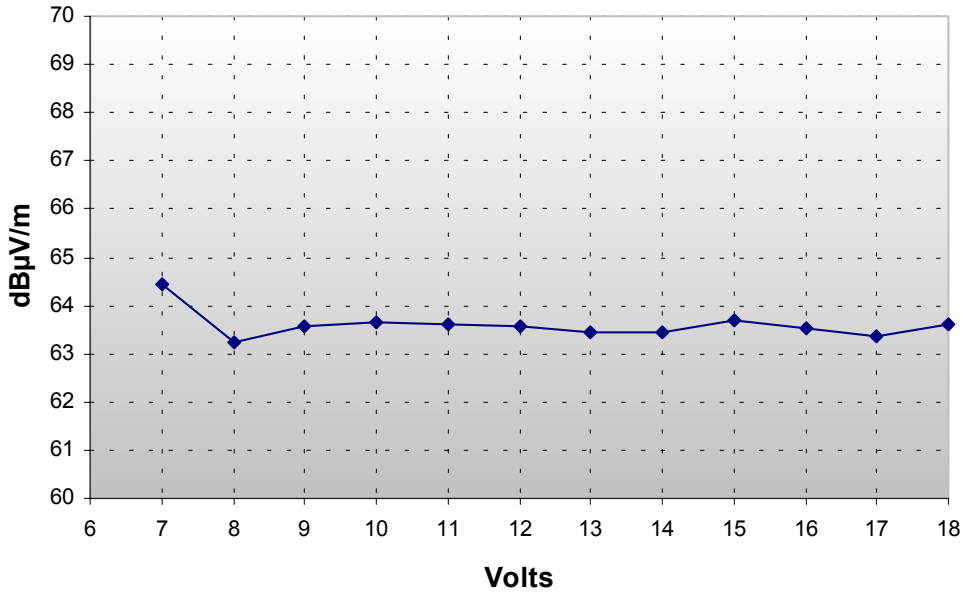
FCC Part 15.31 (e)

For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage.

TX OUTPUT vs. Voltage LEVEL EuT = R171, 310 MHz, 80 % duty cycle		
Volt in	Frequency [MHz]	TX OutPut Pk [dBµV/m]
6,0	no-op	no-op
7,0	309,9038	64,45
8,0	309,8477	63,25
9,0	309,8557	63,56
10,0	309,8557	63,66
11,0	309,8557	63,62
12,0	309,7756	63,56
13,0	309,7916	63,44
14,0	309,7756	63,46
15,0	309,9038	63,70
16,0	309,8076	63,52
17,0	309,7996	63,38
18,0	309,8236	63,60

OUTPUT FIELD STRENGTH vs INPUT VOLTAGE

[Tuned to 310 MHz, modulated at 500 Hz, 80 % duty cycle]



Attachment A: Test data

Restricted Bands

FCC Part 15.205

The following frequency bands are restricted. Only spurious emissions are permitted at levels limited by 15.209:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	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	Above 38.6
13.36 - 13.41			

Verification of no capability to tune within the Restricted Bands.

The unit is designed capable of tuning from 285 MHz to 420 MHz. Except that the Homelink® III firmware prevents the possibility of tuning to the 304 – 307 MHz band and to the restricted regions of 322 – 325.4 MHz, 399.9 – 410 MHz, and 240 – 285 MHz.

An exersice which attempted to train the units into these prohibited bands demonstrated how well the firmware functioned. The unit could not be trained any closer to the restricted band area than 1 MHz outside the restricted bands edges.

The spurious emissions observed in the restricted bands did not exceed the allowed limits for restricted bands.

Attachment A: Test data

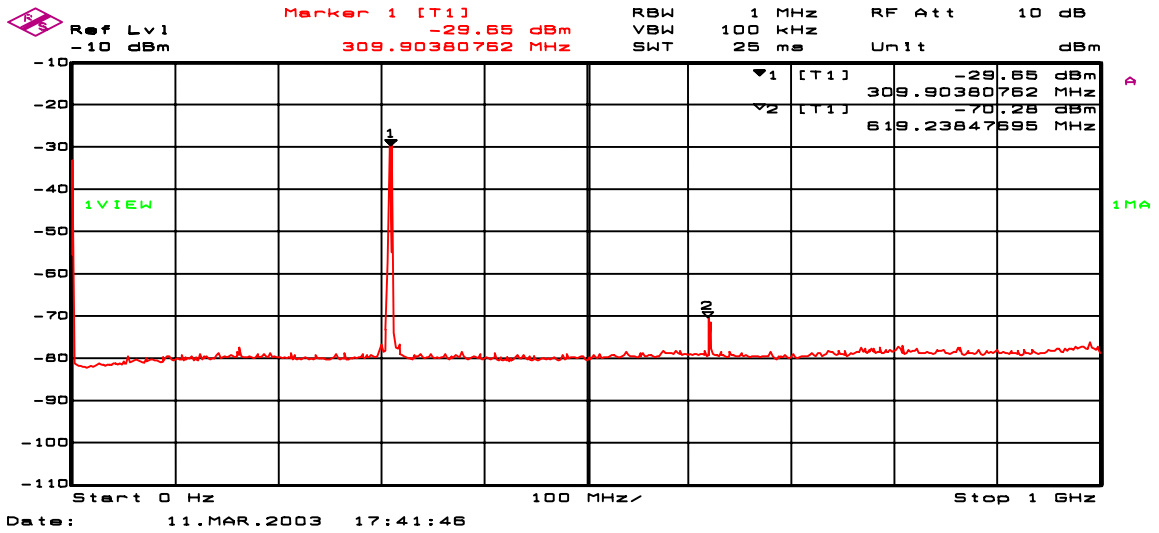
Radiated Field Strength Measurements

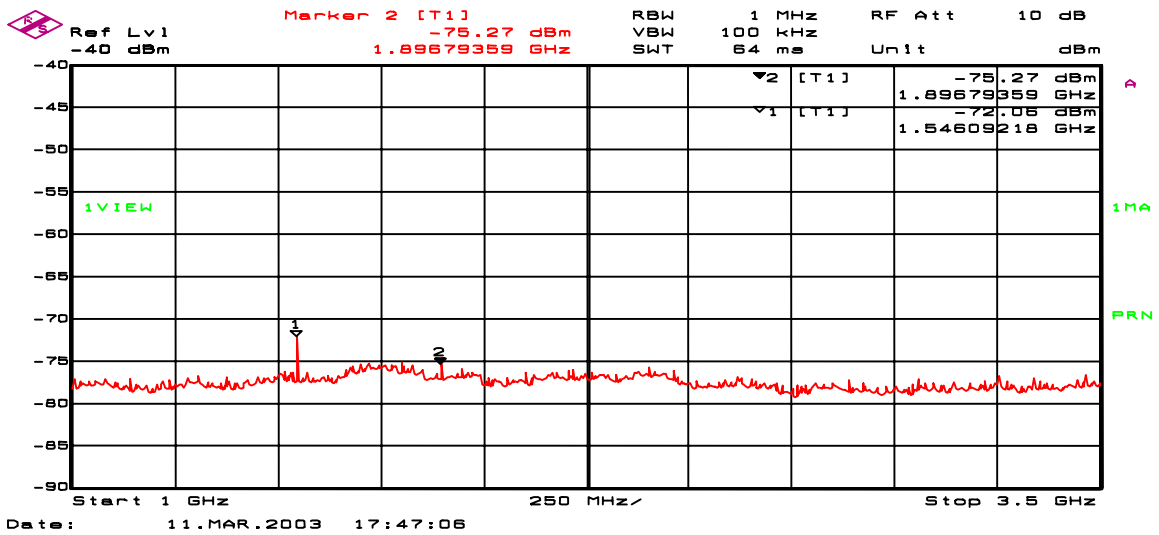
FCC Part 15.231 (b)

A scan of the R171 was made in a shielded room to study the emissions profile of the EuT. The scans indicate there are only the fundamental and its associated harmonics. These emission are measured at the open area test site / anechoic chamber and described in the test report.

This charts shows a typical measured frequency spectrum up to the 10th harmonic

Eut tuned to 310 MHz, 80 % duty cycle





Attachment A: Test data

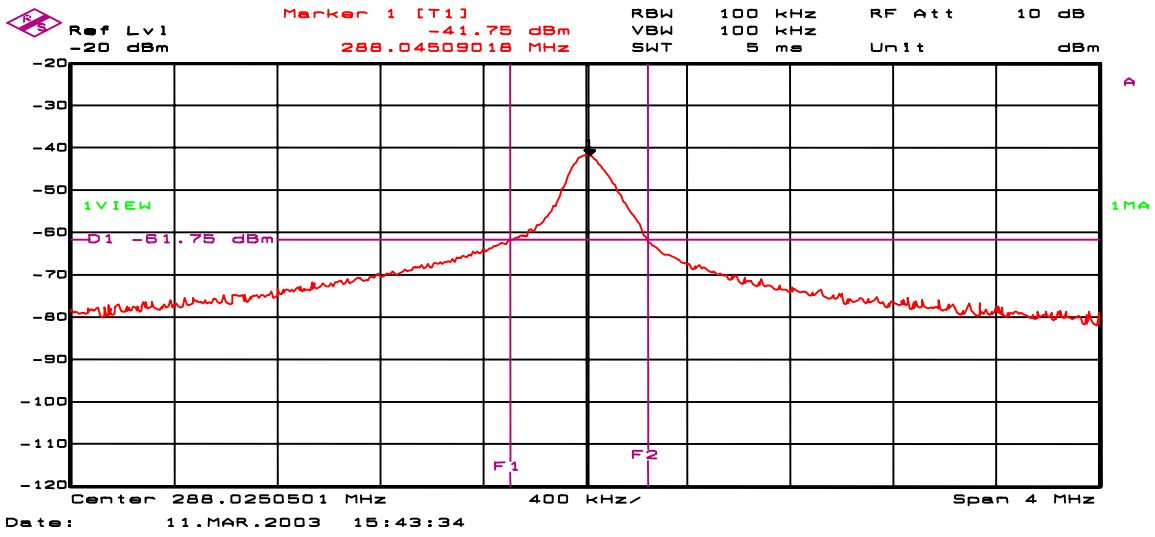
Occupied Bandwith

FCC Part 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. Bandwidth is determined at the points 20 dB down from the modulated carrier.

Fundamental [MHz]	Duty Cycle	20 dB Bandwith F1	20 dB Bandwith F2	Measured Bandwith	LIMIT Fundamental f * 0.0025
288	30%	287.729 MHz	288.267 MHz	538 kHz	720 kHz
288	50%	287.641 MHz	288.243 MHz	602 kHz	720 kHz
288	80%	287.721 MHz	288.171 MHz	450 kHz	720 kHz
310	30%	309.735 MHz	310.207 MHz	472 kHz	775 kHz
310	50%	309.655 MHz	310.119 MHz	464 kHz	775 kHz
310	80%	309.647 MHz	310.127 MHz	480 kHz	775 kHz
418	30%	417.852 MHz	418.324 MHz	472 kHz	1045 kHz
418	50%	417.732 MHz	418.196 MHz	464 kHz	1045 kHz
418	80%	417.660 MHz	418.132 MHz	472 kHz	1045 kHz

Eut tuned to 288 MHz, 30 % duty cycle

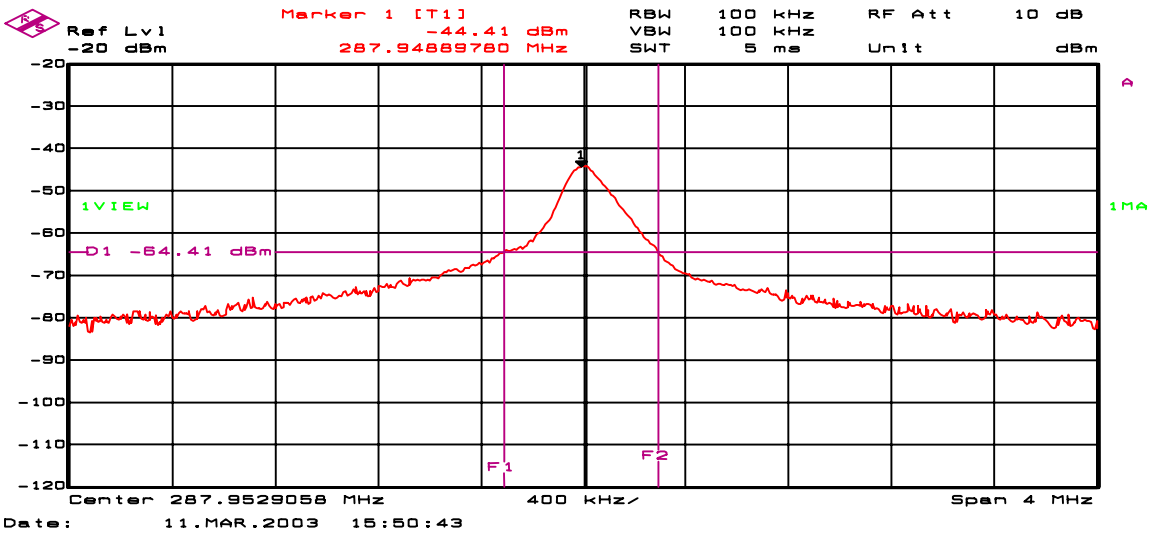


Attachment A: Test data

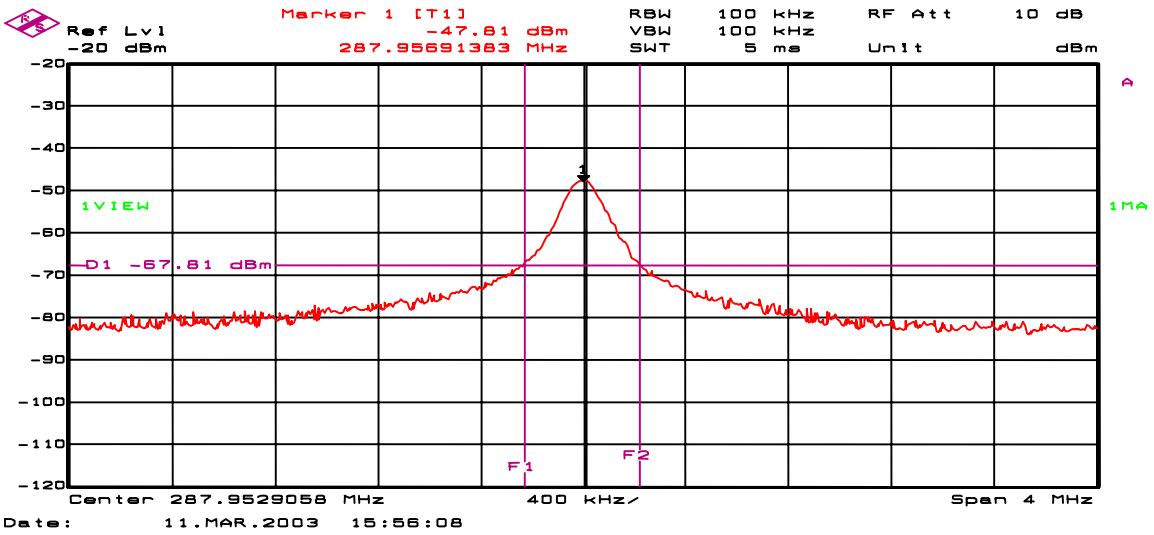
Occupied Bandwith

FCC Part 15.231 (c)

Eut tuned to 288 MHz, 50 % duty cycle



Eut tuned to 288 MHz, 80 % duty cycle

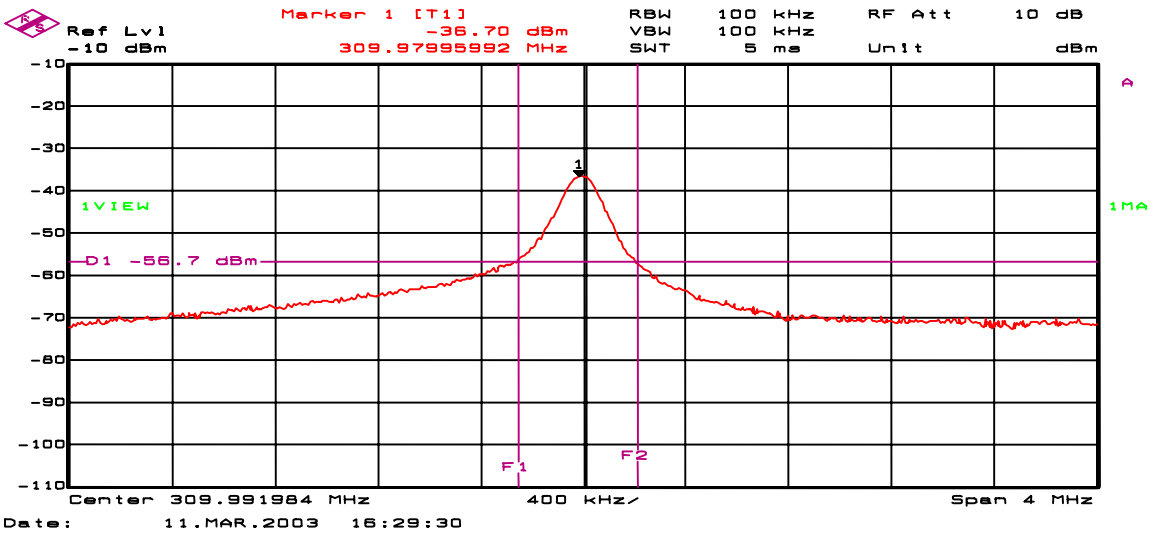


Attachment A: Test data

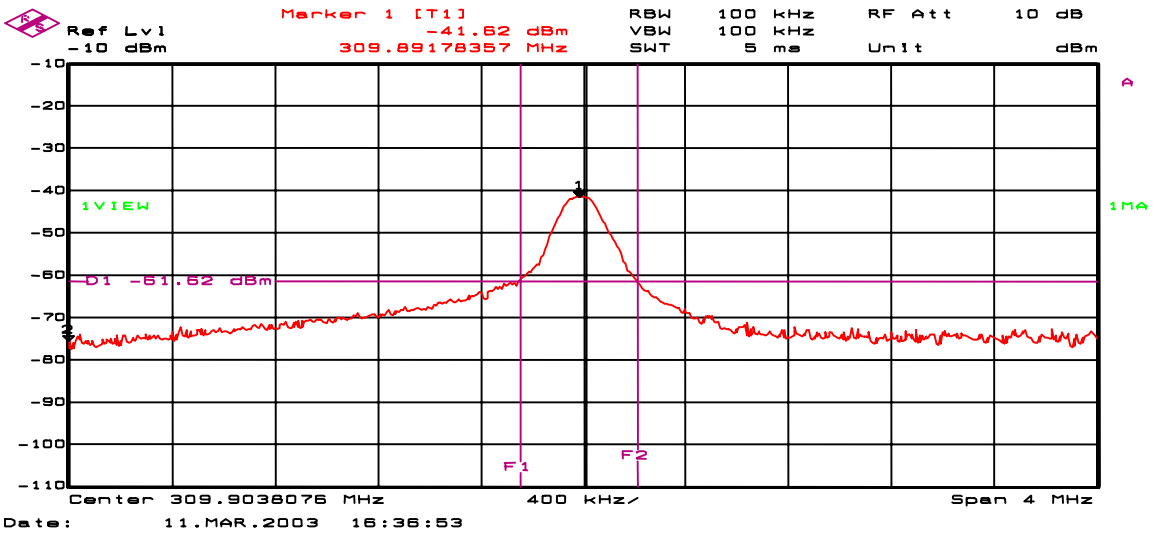
Occupied Bandwith

FCC Part 15.231 (c)

Eut tuned to 310 MHz, 30 % duty cycle



Eut tuned to 310 MHz, 50 % duty cycle

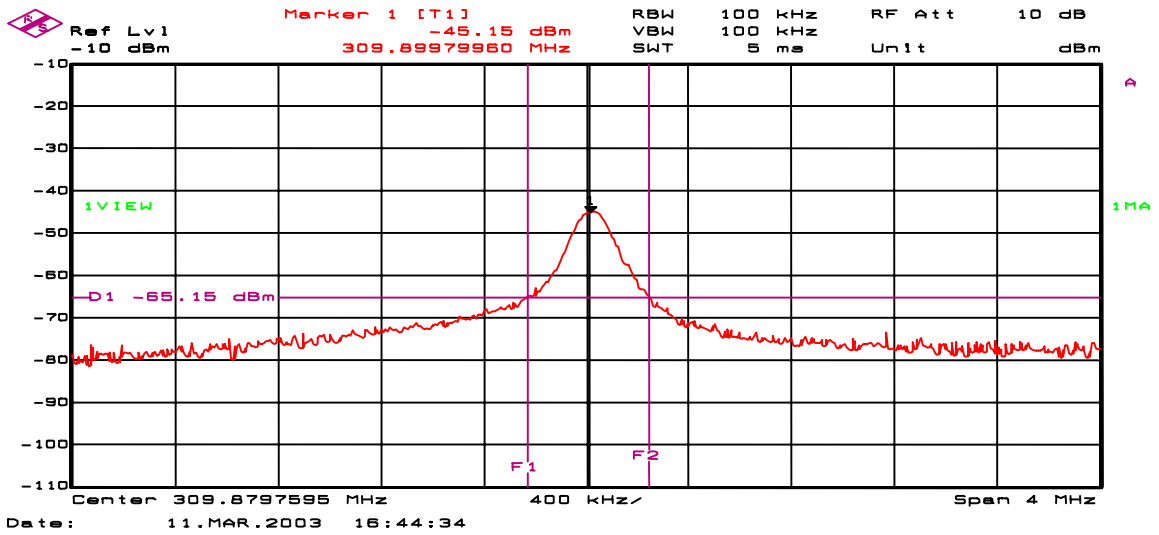


Attachment A: Test data

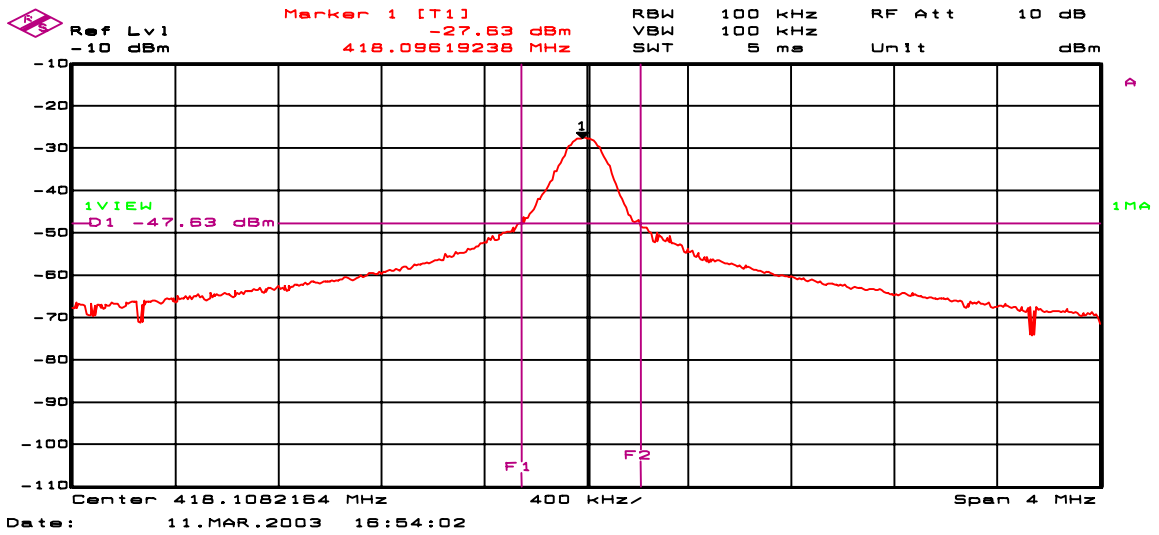
Occupied Bandwith

FCC Part 15.231 (c)

Eut tuned to 310 MHz, 80 % duty cycle



Eut tuned to 418 MHz, 30 % duty cycle

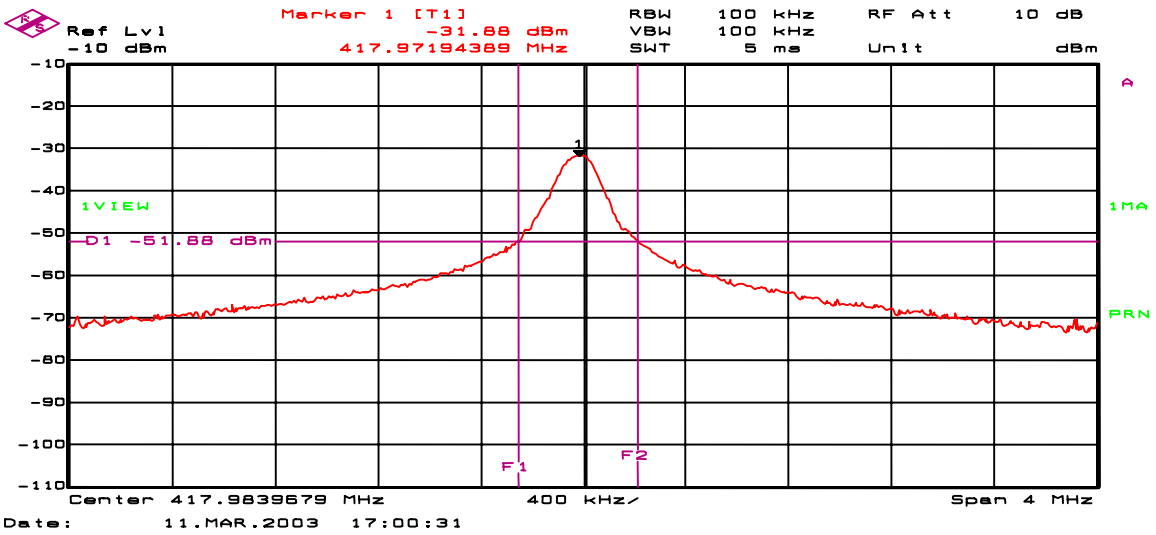


Attachment A: Test data

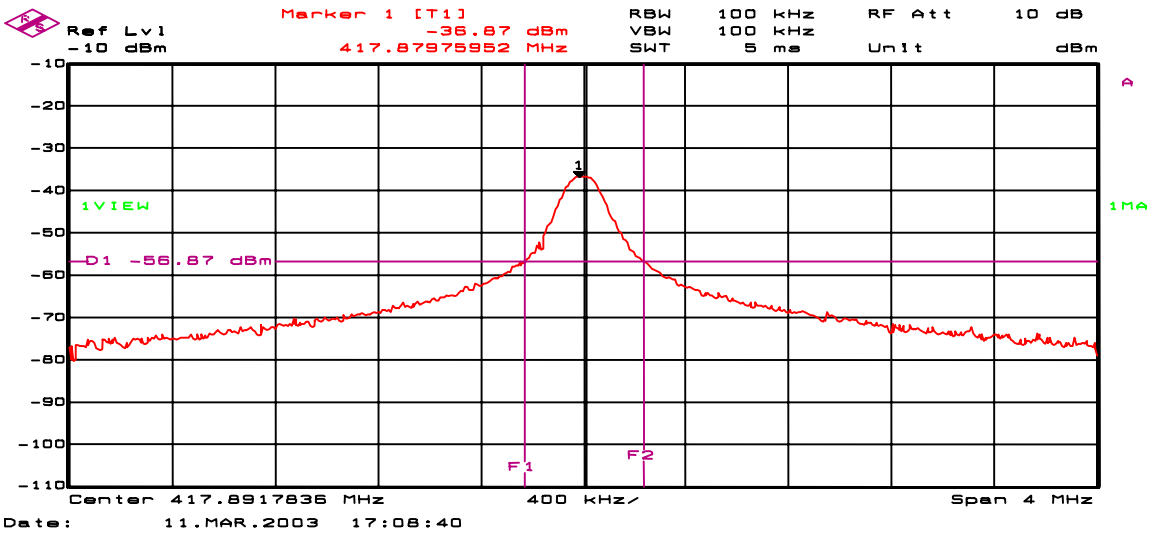
Occupied Bandwith

FCC Part 15.231 (c)

Eut tuned to 418 MHz, 50 % duty cycle



Eut tuned to 418 MHz, 80 % duty cycle



Attachment A: Test data

Calculation of Field Strength of Tuning Pulses

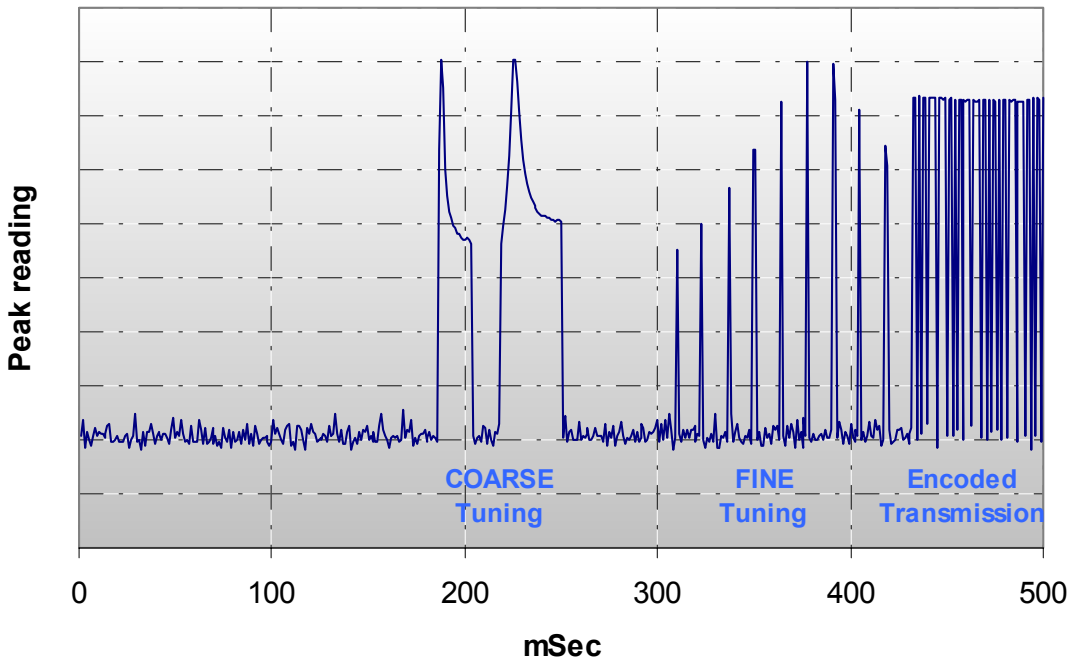
FCC Part15.231 (b), FCC Part 15.31 (c)

The tuning pulses are generated each time the R171 is activated.

The tuning pulse sequence is: During the first 100 mSec of activation two pulses of a “coarse” tune. During the second 100 mSec of activation are nine pulses of a “fine” tune. At approcimately 200 mSec after activation the encoded transmission begins.

The signal levels of the uning pulses were maximized by maximizing the signal levels of the pulse modulated transmission. The antenna height and turntable azimuth for maximum emission levels were adjusted while measuring the field strenth of the pulse modulated transmissions.

A typical tuning pulse sequence is prsented in this figure below.



Attachment A: Test data

Calculation of Field Strength of Tuning Pulses

FCC Part15.231 (b), FCC Part 15.31 (c)

Pursuant to 47 CFR 15.35(c), the field strength is determined by averaging over ONE complete pulse train up to 100 mSec, including blanking intervals.

1. First was determined the numer of deata points captured which represented 100 mSec span of time. There are 500 data points stored for one complete trace. The scan rate of the R&S FSEM 30 spectrum analyser was set to capture the tuning pulses.

   Therefore: Number of data points per 100 mSec
   = 100 mSec * (500 pts / scan) / (No. of mSex/scan).

   Example: If the scan rate is set at 120 mSec, then the number of data points per 100 mSec is
   = 100 mSec * (500 pts / 120 mSec) = 416.7 pts.

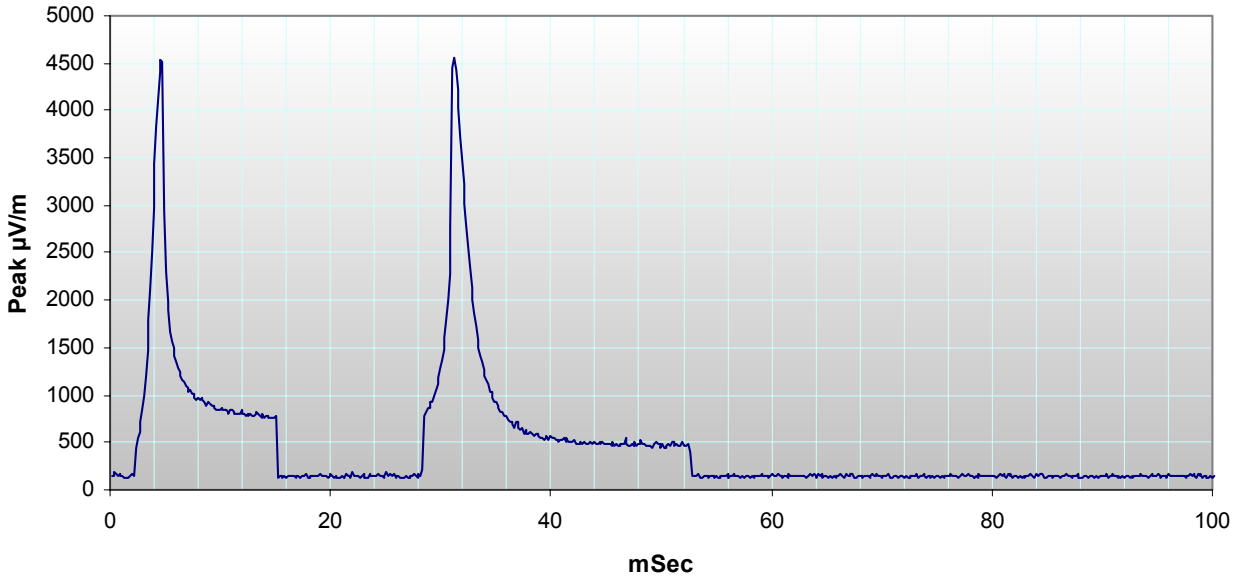
2. The AVERAGE field strength level (µV/m) within the 100 mSec is then determined by dividing SUM of the levels (µV/m) of all data points by the number of data points.

   Formula 3: Average Field Intensity

$$\text{Avg.F.I.} = \frac{\sum_{n=1}^{\text{no. of data points}} (Level_n)\mu V/m}{(\text{number of data points})}$$

The charts that follow are the reproduction of the coarse tune pulse traces using numer of data points representing 100 mSec sweep time from the screen desplay of the R&S FSEM 30 spectrum analyser.

Coarse Tune Pulses, 288 MHz fundamental
Linear Scale

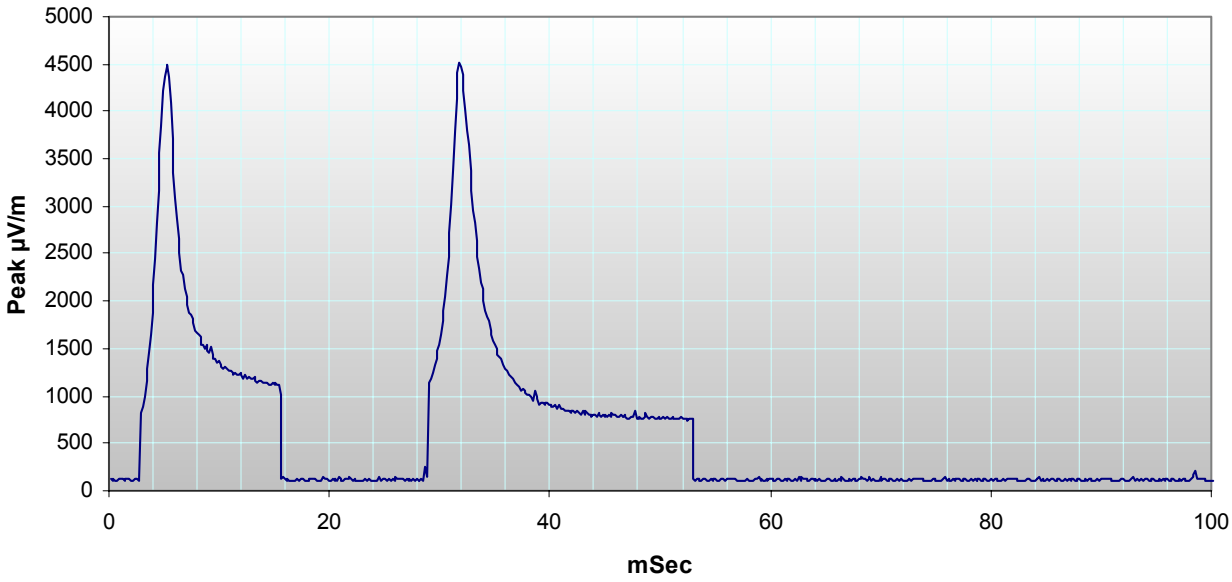


Attachment A: Test data

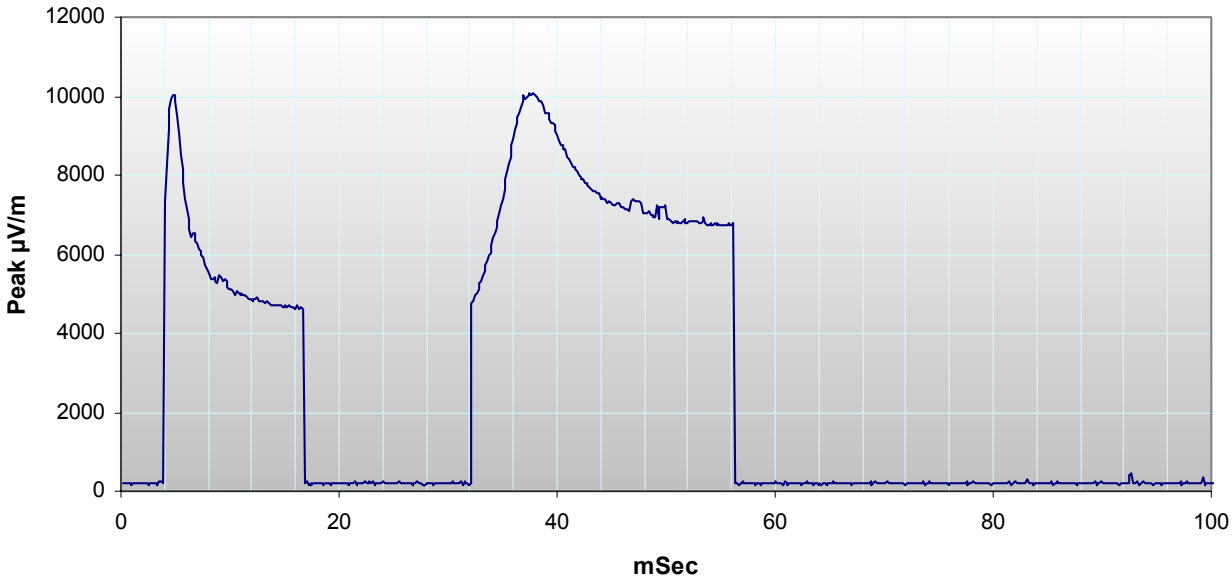
Calculation of Field Strength of Tuning Pulses

FCC Part15.231 (b), FCC Part 15.31 (c)

Coarse Tune Pulses, 310 MHz fundamental
Linear Scale



Coarse Tune Pulses, 418 MHz fundamental
Linear Scale

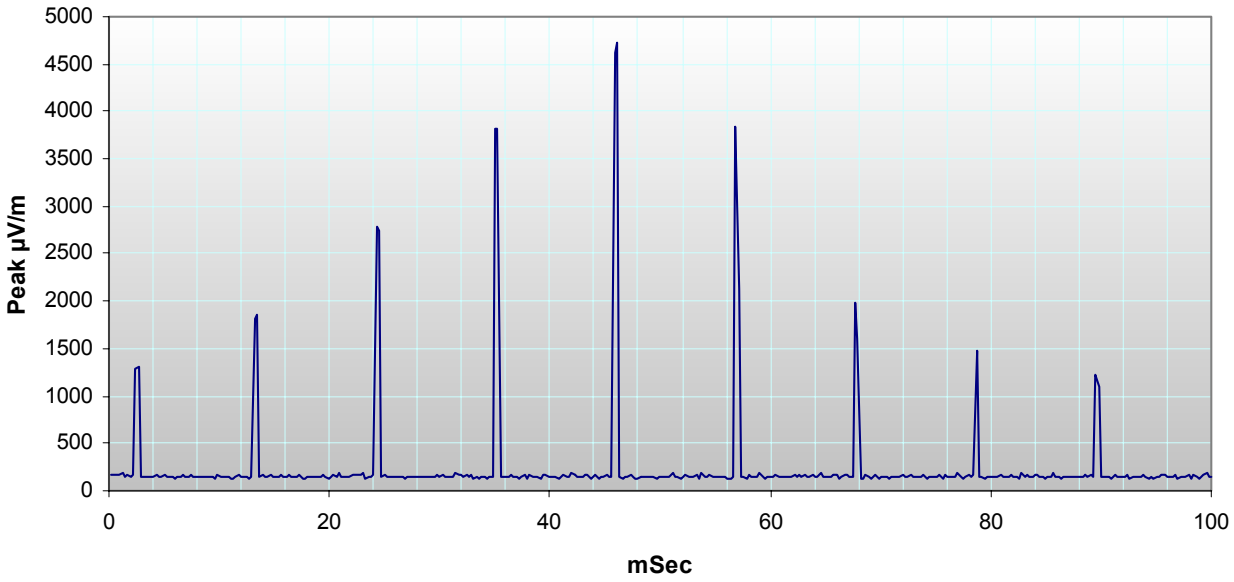


Attachment A: Test data

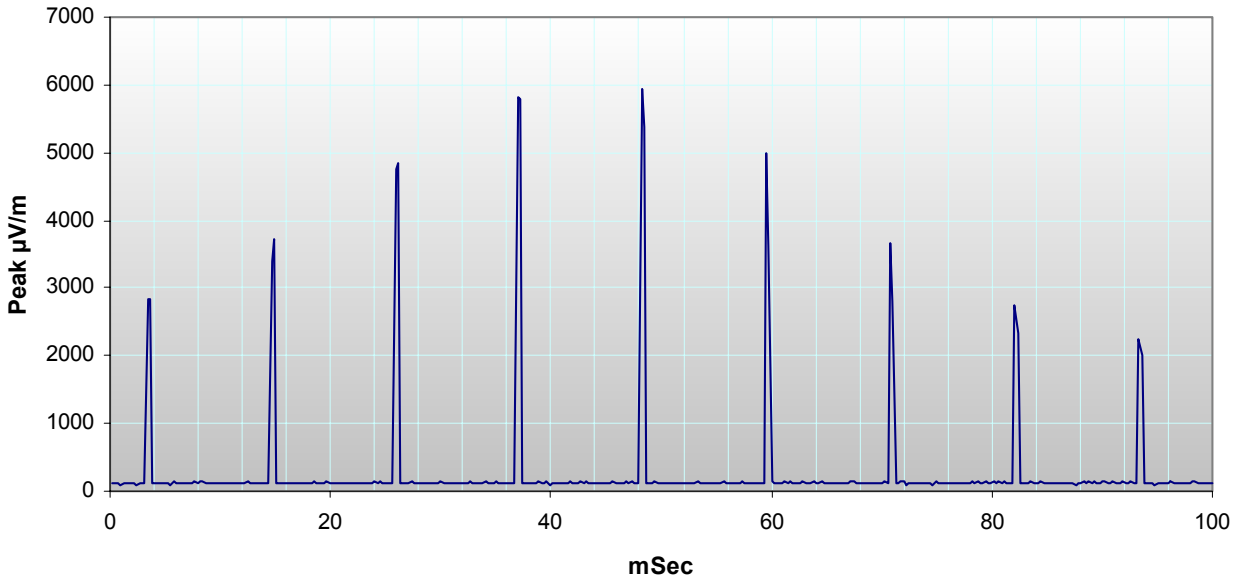
Calculation of Field Strength of Tuning Pulses

FCC Part15.231 (b), FCC Part 15.31 (c)

Fine Tune Pulses, 288 MHz fundamental
Linear Scale



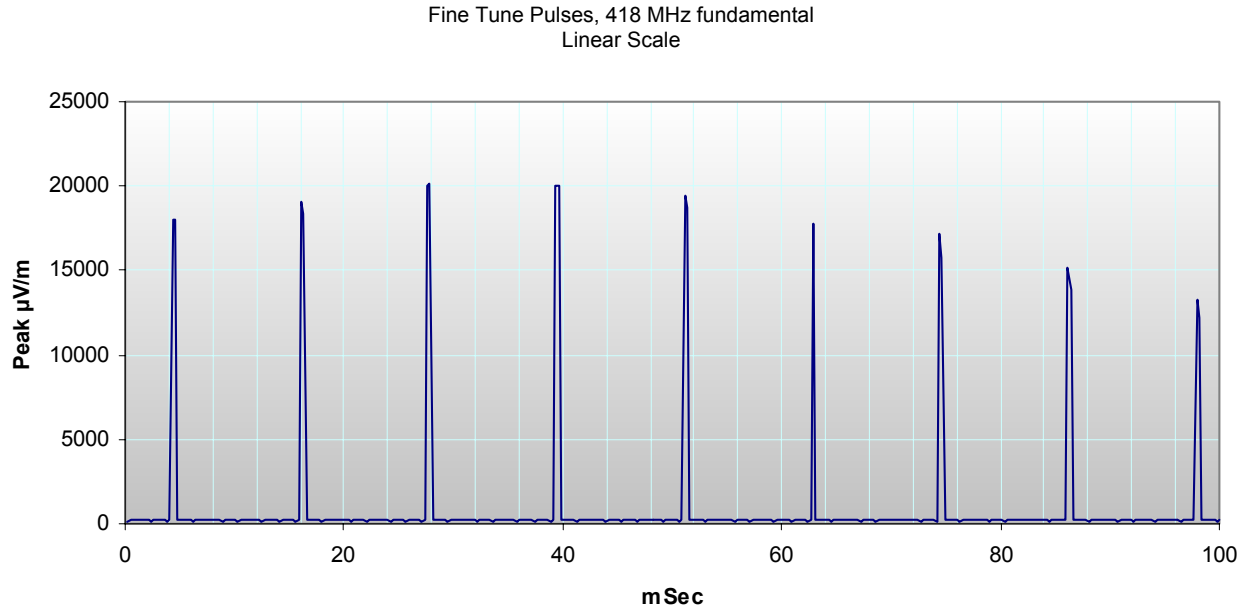
Fine Tune Pulses, 310 MHz fundamental
Linear Scale



Attachment A: Test data

Calculation of Field Strength of Tuning Pulses

FCC Part15.231 (b), FCC Part 15.31 (c)



The raw data used in calculating the average field strength intensity of the tuning pulses are presented in the Appendix of this test report.

COARSE TUNE PULSES, Calculated average over 100 mSec

TX Freq. [MHz]	SUM of the levels of all data Points in 100 mSec span [µV/m)	Number of data points In 100 mSec span [N]	Average SUM/N [µV/m]	Limit 10 m [µV/m]	MARGIN [dB]
288	338720.76	715	473.74	1474.6	9.9
310	439692.88	715	614.96	1749.5	9.1
418	1911942.79	715	2674.05	3099.1	1.3

FINE TUNE PULSES, Calculated average over 100 mSec

TX Freq. [MHz]	SUM of the levels of all data Points in 100 mSec span [µV/m)	Number of data points In 100 mSec span [N]	Average SUM/N [µV/m]	Limit 10 m [µV/m]	MARGIN [dB]
288	102273.80	417	245.26	1474.6	15.6

Attachment A: Test data

310	118428.09	417	284.00	1749.5	15.8
418	374112.88	417	897.15	3099.1	10.8

Attachment B: List of test equipment

Test Report No:	T23230-00-00KJ
Beginning of Testing:	03 März 2003
End of Testing:	11 März 2003

All test instruments used, in addition to the test accessories, are calibrated and verified regularly.

Test ID	Model Type	Kind of Equipment	Manufacturer	Equipment No.	Next cal. date
CPR2	3231-T25/E	Power Supply	Conrad Elektronic GmbH	04-07/49-95-279	
	Controller for Turntable	Controller	EMISYS Vertriebs GmbH	04-07/59-89-157	
	HCC	Controller Ant.-Mast	Rohde & Schwarz München	04-07/59-97-001	
	RG 214/U	RF Cable 2 m	Huber+Suhner	04-07/60-89-463	
	HF 7/8 inch	Antenna Cable 13 m	Huber+Suhner	04-07/60-99-001	
	HF 7/8 inch	Antenna Cable 20 m	Huber+Suhner	04-07/60-99-002	
	HF 7/8 inch	Antenna Cable 40 m	Huber+Suhner	04-07/60-99-003	
	KR - 200	Coax Antenna Switch	Rosenberger HF-Technik	04-07/60-99-004	
	VULB - 9165	Super Broadband Antenna	Schwarzbeck Mess-Elektronik	04-07/62-00-001	19.11.03
	ESVP	Test Receiver	Rohde & Schwarz München	04-07/63-89-008	13.01.03
	ESVP-EZM	Spectrum Monitor	Rohde & Schwarz München	04-07/74-86-016	
	FSEM 30	Spectrum Analyser	Rohde & Schwarz München	04-07/74-97-001	08.01.04
	Turntable 5 m	Turntable	EMISYS Vertriebs GmbH	04-07/92-88-155	
	Antenna Mast	Antenna Mast	Rohde & Schwarz München	04-07/92-97-001	
SER2	3231-T25/E	Power Supply	Conrad Elektronic GmbH	04-07/49-95-279	
	Controller for Turntable	Controller	EMISYS Vertriebs GmbH	04-07/59-89-157	
	HCC	Controller Ant.-Mast	Rohde & Schwarz München	04-07/59-97-001	
	RG 214/U	RF Cable 2 m	Huber+Suhner	04-07/60-89-463	
	HF 7/8 inch	Antenna Cable 13 m	Huber+Suhner	04-07/60-99-001	
	HF 7/8 inch	Antenna Cable 20 m	Huber+Suhner	04-07/60-99-002	
	HF 7/8 inch	Antenna Cable 40 m	Huber+Suhner	04-07/60-99-003	
	KR - 200	Coax Antenna Switch	Rosenberger HF-Technik	04-07/60-99-004	
	VULB - 9165	Super Broadband Antenna	Schwarzbeck Mess-Elektronik	04-07/62-00-001	19.11.03
	ESVP	Test Receiver	Rohde & Schwarz München	04-07/63-89-008	13.01.03
	ESVP-EZM	Spectrum Monitor	Rohde & Schwarz München	04-07/74-86-016	
	Turntable 5 m	Turntable	EMISYS Vertriebs GmbH	04-07/92-88-155	
	Antenna Mast	Antenna Mast	Rohde & Schwarz München	04-07/92-97-001	
SER3	12/15 Volt DC	Power Supply >1GHz	SBF electronic	04-07/49-02-002	
	3231-T25/E	Power Supply	Conrad Elektronic GmbH	04-07/49-95-279	
	MDCON-201	Mast/Turntable Controller	SBF electronic	04-07/59-01-001	
	Sucoflex 102-SMA/2000	RF Cable	Huber+Suhner	04-07/60-03-001	
	Sucoflex 102-SMA/3000	RF Cable	Huber+Suhner	04-07/60-03-002	
	WHJ1000/6000-10EE	High Pass Filter	Wavetek GmbH	04-07/60-98-042	
	Model 3115	Horn Antenna	EMCO Elektronik GmbH	04-07/62-96-458	
	AWT-4534	Microwave Amplifier	TransTech Hochfrequenztechnik	04-07/66-90-217	
	FSEM 30	Spectrum Analyser	Rohde & Schwarz München	04-07/74-97-001	08.01.04
	Turntable 2 m	Turntable	EMISYS Vertriebs GmbH	04-07/92-89-160	

Attachment D: Constructional dataform for testing of radio equipment

Licence holder:	Johnson Controls GmbH attn. Dan Brasier		
Address:	Industriestrasse 20-30, D-51399 Burscheid, Germany		
Manufacturer:	Johnson Controls GmbH		
Address:	Industriestrasse 20-30, D-51399 Burscheid, Germany		
Type:	HomeLink 3		
Model:	R171		
Serial-No.:		Protection class:	

Additional informations to the above named model:

Antenna:			
transmitter:	Type: Loop		
	Length/size: : 37mm X 10mm X 6mm		
receiver:	Type:		
	Length/size:		
Power supply of the transmitter:			
Type:		nominal voltage:	**12 V**
		lowest voltage:	**9 V**
		highest voltage:	**16 V**
		current consumption	**48 mA**
Power supply of the receiver:			
Type:		nominal voltage:	
		current consumption	

Ancillary equipment:

Description:	none	Type:		Serial-no.:	
Description:		Type:		Serial-no.:	
Description:		Type:		Serial-no.:	

Extreme temperature range in which the approval test should be performed:

O Category I: General (-20°C to +55°C)
O Category II: Portable (-10°C to +55°C)
O Category III: Equipment for normal indoor use (0°C to +55°C)

Connectable cables:

Name of the cable	Digital	Length/m	shielded
None	O yes O no		O yes O no
	O yes O no		O yes O no
	O yes O no		O yes O no
	O yes O no		O yes O no
	O yes O no		O yes O no

Attachment D: Constructional dataform for testing of radio equipment

Type designation:
(Universal Garage Door Opener)

Name and type designation of individual units comprising the radio equipment:

Type of equipment:

☐ Radiotelephone equipment	x Remote-control equipment	☐ Radiomaritime equipment	x LPD
☐ One-way radiotelephone equipment	☐ Inductive loop system	☐ Inland waterways equipment	☐ RLAN
☐ Personal paging system	☐ Radio-relay system	☐ Radionavigation equipm.	☐
☐ Satellite earth station	☐ CB radiotelephone equipment	☐ Antenna	☐
☐ Data transmission equipment	☐ Movement detector	☐ Aeronautical equipment	☐

Technical characteristics:

	Transmitter-receiver	Transmitter	Receiver
Frequency range	**288-418 MHz**		
Maximum no. of channels			
Channel spacing	**+/- 500 kHz of original transmitter trained with (spec)**		
Class of emission (type of modulation)	**AM (ASK)**		
Maximum RF output power	**(adjusted to FCC limit)**		
Maximum effective radiated power (ERP)	**See test results**		
Output power variable	**YES**		
Channel switching frequency range	**288-418 MHz**		

Method of frequency generation	X Synthesizer	☐ Crystal	☐ Other
Frequency generation TX	**PLL Synth**		
Frequency generation RX	**PLL Synth**		
IF	1st IF **10,7 MHz**	2nd IF	3rd IF
Integral selective calling	**N/A**		
Audio-frequency interface level at external data socket	**N/A**		
Modes of operation	☐ Duplex mode	☐ Semi-duplex mode	X Simplex mode
Power source	☐ Mains	X Vehicle-regulated	☐ Integral
Antenna socket	☐ BNC ☐ M X None	☐ TNC ☐ UHF ☐	☐ N ☐ Adapter ☐

Test specifications:

Attachment D: Constructional dataform for testing of radio equipment

Declarations:

- We declare that the above information are correct and the named model was supplied with the maximum configuration to the accredited test laboratory.

Burscheid ,date 16 April 2003

place of issue

JOHNSON CONTROLS

Seal and signature of applicant

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