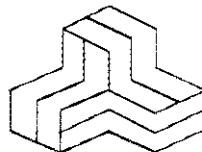


ENGINEERING TEST REPORT



ROLL CAGE TAG MODEL NO.: TRC95

In Accordance With

**FEDERAL COMMUNICATIONS COMMISSION (FCC)
PART 15, SUBPART C, SEC. 15.231
PERIODIC OPERATION AT 433.92 MHz**

UltraTech's FILE NO.: KAS-037FCC15C

Tested for:

KASTEN CHASE APPLIED RESEARCH

1331 Crestlawn Drive
Mississauga, Ontario
Canada, L4W 2P9

Tested by:

UltraTech - Group of Labs

3000 Bristol Circle
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Report Prepared by: Tri M. Luu

DATE: Apr. 24, 1999

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1. **EXHIBIT 1 - SUMMARY OF TEST RESULTS & GENERAL STATEMENT OF CERTIFICATION**

FCC PARAGRAPH.	TEST REQUIREMENTS	COMPLIANCE (YES/NO)
15.203	Antenna Requirement	Yes
15.231(a)	Provisions of FCC 15.231	Yes
15.231(a) & (b)	Transmitter Radiated Emissions - Fundamental, Harmonic and Spurious	Yes
15.231(c)	20 dB Bandwidth	Yes
15.107, 15.109	AC Power Conducted Emissions & Radiated Emissions for Receiver and Digital Circuit Portions	Not applicable for battery operated device.

TESTIMONIAL AND STATEMENT OF CERTIFICATION

THIS IS TO CERTIFY:

- 1) THAT the application was prepared either by, or under the direct supervision of the undersigned.
- 2) THAT the measurement data supplied with the application was taken under my direction and supervision.
- 3) THAT the data was obtained on representative production units, randomly selected.
- 4) THAT, to the best of my knowledge and belief, the facts set forth in the application and accompanying technical data are true and correct.

Certified by:

Tri Minh Luu, P. Eng.
V.P., Engineering

DATE: Apr. 24, 1999

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2. **EXHIBIT 2 - GENERAL INFORMATION**

2.1. **APPLICANT**

KASTEN CHASE APPLIED RESEARCH
1331 Crestlawn Drive
Mississauga, Ontario
Canada, L4W 2P9

Applicant's Representative: Ms. Mary Huzum

2.2. **MANUFACTURER**

KASTEN CHASE APPLIED RESEARCH
5100 Orbitor Drive
Mississauga, Ontario
Canada, L4W 4Z4

2.3. **DESCRIPTION OF EQUIPMENT UNDER TEST**

The TRC95 is a standalone unit with no buffered modulation data input/output interface. The antenna is an integral part of the transmitter's printed circuit board.

PRODUCT NAME:	ROLL CAGE TAG
MODEL NO.:	TRC95
SERIAL NUMBER:	7777
TYPE OF EQUIPMENT:	Periodic Low Power Transmitters
OPERATING FREQ.:	433.92 MHz
BANDWIDTH (26 dB OBW):	120 kHz
POWER RATING:	7.9 μ W EIRP
EMISSION DESIGNATION @ 15.201:	120K0F1D
DUTY CYCLE:	71 %
INPUT SUPPLY:	3 Vdc battery
CPU CLOCK:	3.58 MHz
ASSOCIATED DEVICES:	Kasten Chase E95 Exciter, FCC ID: NDJE95 and R95 Receiver, FCC ID: NDJR95
INTERFACE PORTS:	N/A

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2.4. RELATED SUBMITTAL(S)/GRANT

This transmitter is designed to work with the Kasten Chase E95 Exciter, FCC ID: NDJE95 and R95 Receiver, FCC ID: NDJR95. This Roll Cage Tag TRC95 operates in the same way as the Postag T95 which was certified with FCC under FCC ID: NDJT95.

2.5. TEST METHODOLOGY

These tests were conducted on a sample of the equipment for the purpose of certification compliance with Code of Federal Regulations (CFR47-1991), Part 15, Subpart C, Para. 15.231, Periodic Low Power Transmitters

Radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4-1992 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 KHz to 40 GHz.

2.6. TEST FACILITY

Radiated Emissions were performed at the UltraTech's 3-10 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario.

The above site have been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville Open Field Test Site has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: IC2049). Last Date of Site Calibration: September 1998.

The above test site is also filed with Interference Technology International Ltd (ITI - An EC Directive on EMC).

2.7. UNITS OF MEASUREMENTS

Measurements of radiated emissions are reported in units of dB referenced to one microvolt per meter [dB(uV)/m] at the distance specified in the report, wherever it is applicable.

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3. EXHIBIT 3 - SYSTEM TEST CONFIGURATION

3.1. BLOCK DIAGRAMS FOR CONDUCTED & RADIATED EMISSION MEASUREMENTS

Please refer to the photograph of set-up in Sec. 3.3 as a standalone device.

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3.3. JUSTIFICATION

A jumper was specially made to force the transmitter to operate continuously; this is not a normal operation

3.4. EUT OPERATING CONDITION

The transmitter was set to operate continuously for testing.

3.5. SPECIAL ACCESSORIES

No special accessories were required.

3.6. EQUIPMENT MODIFICATIONS

Not applicable.

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4. EXHIBIT 4 - TEST DATA

4.1. ANTENNA REQUIREMENTS @ FCC CFR 47, PARA 15.203

PRODUCT NAME: ROLL CAGE TAG, Model No.: TRC95

FCC REQUIREMENTS:

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.

Notes: This requirement does not apply to carrier current devices operated under the provisions of @ 15.211, 15.213, 15.217, 17.219 or 15.221.

ENGINEERING ANALYSIS:

Internal integral antenna component mounted on the printed circuit board.

TEST RESULTS: Conforms.

TEST PERSONNEL: Hung Trinh, EMI/RFI Technician

DATE: Apr. 22/1999

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4.2. PROVISIONS OF FCC 15.231(A) FOR PERIODIC TRANSMITTERS**PRODUCT NAME:** ROLL CAGE TAG, Model No.: TRC95**ENGINEERING ANALYSIS**

FCC PROVISIONS	ANALYSIS ON COMPLIANCE
Permitted Type of Devices (alarm systems, door opener, remote switches etc ...)	Alarm System
Prohibited Type of Devices (radio control of toys)	Not radio control toys
Prohibited Transmission Type (voice, video or data continuous transmission)	Recognition codes to identify other particular component as part of the system
A Manually Operated Transmitter (shall employ with the switch that automatically deactivate the transmitter within 5 seconds of being released)	The transmitter is automatically deactivated within less than 1 seconds of being releases.
Periodic Transmissions: at regular predetermined intervals are not permitted. However, polling or supervision transmissions to determine system integrity of transmitter 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 the transmitter Internal Radiators which are not employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.	Not applicable

TEST RESULTS: Conforms.**TEST PERSONNEL:** Hung Trinh, EMI/RFI Technician**DATE:** Apr. 22/1999**ULTRATECH GROUP OF LABS**

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4.3. TRANSMITTER RADIATED EMISSIONS @ 3 METERS, FCC CFR 47, PARA. 15.231(B)(C), 15.209 & 15.205

PRODUCT NAME: ROLL CAGE TAG, Model No.: TRC95

FCC REQUIREMENTS:

The RF radiated emissions measured at 3 Meter distance shall not exceed the field strength below:

Fundamental Frequency (MHz)	Average Field Strength Limits (V)	
	Fundamental	Harmonic/Spurious
260 - 470 MHz	*3750 - 12,500	*375 - 1250

* Linear interpolations.

All other emissions inside restricted bands specified in @ 15.205(a) shall not exceed the general radiated emission limits specified in @ 15.209(a)

Remarks:

- Applies to harmonics/spurious emissions that fall in the restricted bands listed in Section 15.205. The maximum permitted average field strength is listed in Section 15.209.
- @ **FCC CFR 47, Para. 15.237(c)** - The emission limits as specified above are based on measurement instrument employing an average detector. The provisions in @15.35 for limiting peak emissions apply.

FCC CFR 47, Part 15, Subpart C, Para. 15.205(a) - Restricted Frequency Bands

MHz	MHz	MHz	GHz
0.090 - 0.110	162.0125 - 167.17	2310 - 2390	9.3 - 9.5
0.49 - 0.51	167.72 - 173.2	2483.5 - 2500	10.6 - 12.7
2.1735 - 2.1905	240 - 285	2655 - 2900	13.25 - 13.4
8.362 - 8.366	322 - 335.4	3260 - 3267	14.47 - 14.5
13.36 - 13.41	399.9 - 410	3332 - 3339	14.35 - 16.2
25.5 - 25.67	608 - 614	3345.8 - 3358	17.7 - 21.4
37.5 - 38.25	960 - 1240	3600 - 4400	22.01 - 23.12
73 - 75.4	1300 - 1427	4500 - 5250	23.6 - 24.0
108 - 121.94	1435 - 1626.5	5350 - 5460	31.2 - 31.8
123 - 138	1660 - 1710	7250 - 7750	36.43 - 36.5
149.9 - 150.05	1718.8 - 1722.2	8025 - 8500	Above 38.6
156.7 - 156.9	2200 - 2300	9000 - 9200	

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FCC CFR 47, Part 15, Subpart C, Para. 15.209(a)
-- Field Strength Limits within Restricted Frequency Bands --

FREQUENCY (MHz)	FIELD STRENGTH LIMITS (microvolts/m)	DISTANCE (Meters)
0.009 - 0.490	2,400 / F (KHz)	300
0.490 - 1.705	24,000 / 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

CLIMATE CONDITION:

Standard Temperature and Humidity:

- Ambient temperature: 23+3 °C
- Relative humidity: 50+5 %
- Atmospheric Pressure: 100+5 kPa

POWER INPUT:

3 Vdc battery.

TEST EQUIPMENT:

- **Spectrum Analyzer**, Advantest, Model R3271, S/N: 15050203, 100 Hz to 32 GHz)
- **Microwave Amplifier**, HP, Model 83017A, Frequency Range 1 to 26.5 GHz, 34-38 dBdB gain nominal.
- **Active Loop Antenna**, Emco, Model 6507, SN 8906-1167, Frequency Range 1 KHz - 30 MHz, @ 50 Ohms
- **Log Periodic/Bow-Tie Antenna**, Emco, Model 3143, SN 1029, 20 - 1000 MHz, @ 50 ohms.
- **Horn Antenna**, Emco, Model 3115, SN 9701-5061, Frequency Range: 1 - 18 GHz, @ 50 Ohms.

METHOD OF MEASUREMENTS:

Refer to **ANSI 63.4-1992, Para. 8** for detailed radiated emissions measurement procedures.

Applies to harmonics/spurious that fall in the restricted bands listed in Section 15.205. the maximum permitted average field strength is listed in Section 15.209. A Pre-Amp and highpass filter are used for this measurement.

- For measurements from 9 KHz to 150 KHz, set RBW = 200 Hz, VBW ≥ RBW, SWEEP=AUTO.
- For measurements from 150 KHz to 30 MHz, set RBW = 10 KHz, VBW ≥ RBW, SWEEP=AUTO.
- For measurements from 30 MHz to 1 GHz, set RBW = 100 KHz, VBW ≥ RBW, SWEEP=AUTO.
- For measurement above ± GHz, set RBW = 1 MHz, VBW = 1 MHz, SWEEP=AUTO.

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If the emission is pulsed, modified the unit for continuous operation, then use the settings above for measurements, then correct the reading by subtracting the peak-average correction factor derived from the appropriate duty cycle calculation. See Section 15.35(b) and (c).

FCC CFR 47, Para. 2.997 - Frequency spectrum to be investigated

The spectrum was investigated from the lowest radio generated in the equipment up to at least the 10th harmonic of the carrier frequency or to the highest frequency practicable in the present state of the art of measuring techniques, whichever is lower. Particular attention should be paid to harmonics and subharmonics of the carrier frequency. Radiation at the frequencies of multiplier stages should be checked. The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

FCC CFR 47, Para. 2.993 - Field Strength Spurious Emissions

- (a) Measurements was made to detect spurious emissions radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data were supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph 2.989(c) as appropriate. For equipment operating on frequencies below 1 GHz, an Open Field Test is normally required, with the measuring instrument antenna located in the far field at all test frequencies. In event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurement will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with the reference to the rated power output of the transmitter, assuming all emissions are radiated from half-wave dipole antennas.
- (b) Measurements specified in paragraph (a) of this section shall be made for the following equipment:
- (1) Those in which the spurious emission are required to be 60 dB or more below the mean power of the transmitter.
 - (2) All equipment operating on frequencies higher than 25 MHz
 - (3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.
 - (4) Other types of equipment as required, when deemed necessary by the Commission.

TEST RESULTS: Conforms.

TEST PERSONNEL: Hung Trinh, EMI/RFI Technician

DATE: Apr. 22/1999

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MEASUREMENT DATA**RADIATED EMISSIONS MEASUREMENTS @ 3 METERS****TEST CONFIGURATION**

- For measurements from 9 KHz to 150 KHz, set RBW = 200 Hz, VBW ≥ RBW, SWEEP=AUTO.
- For measurements from 150 KHz to 30 MHz, set RBW = 10 KHz, VBW ≥ RBW, SWEEP=AUTO.
- For measurements from 30 MHz to 1 GHz, set RBW = 100 KHz, VBW ≥ RBW, SWEEP=AUTO.
- For measurement above 1 GHz, set RBW = 1 MHz, VBW = 1 MHz, SWEEP=AUTO.
- The following measurements were the worst cases when the radiating antenna was placed in both horizontal and vertical polarization.
- The following **AVERAGE** rf levels were obtained from either Peak readings added by the duty cycle correction factor. **DUTY CYCLE FACTOR = $20\log_{10}(0.71) = -3.0\text{dB}$**

The radiated emissions tests were repeated with the EUT placed in three different orthogonal positions (back down, stand up and side up), and the worst case of measurements were recorded as follows:

FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	FCC AVG LIMIT (dBuV/m)	MARGIN (dB)	PASS/ FAIL
433.94	71.2	68.2	V	80.8	-12.6	PASS
433.94	76.5	73.5	H	80.8	-7.3	PASS
867.91	41.6	38.6	V	60.8	-22.2	PASS
867.91	41.5	38.5	H	60.8	-22.3	PASS
1301.83	46.7	43.7	V	54.0	-10.3	*PASS
1301.83	47.2	44.2	H	54.0	-9.8	*PASS
1735.86	58.4	55.4	V	60.8	-5.4	PASS
1735.86	57.9	54.9	H	60.8	-5.9	PASS
2169.75	54.8	51.8	V	60.8	-9.0	PASS
2169.75	51.5	48.5	H	60.8	-12.3	PASS
2603.72	47.7	44.7	V	60.8	-16.1	PASS
2603.72	46.4	43.4	H	60.8	-17.4	PASS
3037.68	49.7	46.7	V	60.8	-14.1	PASS
3037.68	49.8	46.8	H	60.8	-14.0	PASS
3471.55	46.9	43.9	V	60.8	-16.9	PASS
3471.55	48.2	45.2	H	60.8	-15.6	PASS

No other significant emissions were found in the frequency range from 10 MHz to 10 GHz. Refer to attached plots for details

* Emission within the restricted band specified in @ 15.205(a)

REMARKS: The maximum duty cycle of the transmitter can not be easily measured due to its randomness: therefore, the maximum calculated duty cycle value (71%), provided by the manufacturer, was used for calculation the average emission levels.

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Kasten Chase Applied Research	TKC95 Tag T95 Parameters Setup	Doc No: SYS95-01	Rev :
Subject:	Computed limitations for programmable parameters	Date: 7-Mar-97	Page : 1

1. T95 Transmission Algorithm description.

TKC95
To trigger the transmission of T95, the Tag has to be brought into excitation field. When excited, T95 transmits an initial number of messages defined by the "IP" parameter plus some extra messages up to "RC" number if the Tag stays in the field, then it goes to sleep. The maximum number of messages ("IP"+"RC") in one transmission, data rate and message format are user programmable.

Message format, as well as all parameters that define it, is shown in Annex 1.

Time delay between messages is randomized and it is always a multiple of "InterMsgUnit" (see Annex 1). The randomization is implemented in such a way that "OFF" time never repeats itself for 32 messages.

$$\text{Inter Message Delay} = [\text{SD} + \text{RND}(0..31)] * \text{InterMsgUnit},$$

and the general formula for Total Transmission Time of N messages will be :

$$\text{Total Transmission Time} = N * \text{Message Length} + (N-1) * \text{Inter Message Delay}.$$

A detailed description of how to calculate all time intervals used in our final formulas can also be found in Annex 1.

2. Maximum Transmission Time.

FCC requirements:

According to Para. 15.231(a) and (2) of "FCC 47 CFR Ch. I (10-1-95 Edition)", "A transmitter activated automatically shall cease transmission within 5 seconds after activation".

TKC95
To comply with this requirement, T95 programmable parameters will be set below the limits specified later in this document.

Implementation:

To calculate the maximum transmission time we have to consider the worst case scenario, the other words we have to choose the situation when

TLC 95

Kasten Chase Applied Research	Tag 195 Parameters Setup	Doc No: SYS95-01	Rev :
Subject:	Computed limitations for programmable parameters	Date: 7-Mar-97	Page : 2

inter message delays are at their maximum. Given our randomization pattern, the following formula should be used :

$$\text{MaxTime} = N * \text{Message Length} + (\text{SD}+31)*\text{InterMsgUnit} + (\text{SD}+30)*\text{InterMsgUnit} + \dots + (\text{SD}+33-N)*\text{InterMsgUnit}.$$

After simplification this formula comes to :

$$\text{MaxTime} = N * \text{Message Length} + (N-1) * (32 - N/2 + \text{SD} * \text{InterMsgUnit}),$$

where $N=IP+RC$ is the maximum number of transmitted messages, **Message Length** and **InterMsgUnit** are calculated as described in Annex 1. If the number of transmitted messages exceed 32, then we have to apply the following formula:

$$\text{Maximum Transmission Time} = M*\text{MaxTime}(32\text{msgs})+ \text{MaxTime}(N\text{msgs}),$$

where $N\text{msgs}=N\text{mod}32$ (remainder of $N/32$) and M is the integer.

Everything mentioned above was incorporated in order to calculate the maximum allowable number of transmissions providing that we do not exceed 5 second limit. To make the results more explicit and easy to use, we set some parameters to fixed values (worst case scenario) and represented the maximum allowable number of transmissions as a chart (see Annex 2). The chart shows the maximum allowable number of transmissions "IP+RC" with respect to the number of user data characters "CC" and subsequent delay "SD". Given data rate, we can pick the appropriate graph for DR2, DR3, DR4, then choose the number of characters for user data which is "CC" (down) and subsequent delay "SD" (across). the intersection will yield the "IP+RC" number we are interested in (maximum number of allowable transmissions).

Example.

If: DR=4 (38,400bps), CC=05 and SD=33,

then from the chart for "DR4" we can see that Tags must transmit not more than 45 messages (highlighted in Annex 2). So we choose "IP"=30 and "RC"=10.

Since the given example is the most common way to use ^{TLC 95} P95 transponders, we provide an extra graph in Annex 3 showing the overall transmission time in seconds for the "IP+RC" (down) and "SD" (across).

The 25

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3.Duty Cycle

For the Duty Cycle calculation the same approach was used except that for the worst case scenario we have to use the formula where Inter Message Delays are minimal (such that we can put maximum possible number of messages into 100ms time frame):

$$\text{MinTime} = N * \text{Message Length} + (\text{SD}+0)*\text{InterMsgUnit} + \\ + (\text{SD}+1)*\text{InterMsgUnit} + \dots + (\text{SD}+N-2)*\text{InterMsgUnit}.$$

Putting "SD" to its minimum value (to obtain the shortest Inter Message Delay), we get the following :

$$\text{MinTime} = N * (\text{Message Length} + (N - 1) * \text{InterMsgUnit} / 2) = 0.1\text{second}.$$

As before, we have to remember that the number of messages can be more than 32. Keeping that in mind, from this formula we can define the value of N and the Duty Cycle will be:

$$\text{Duty Cycle} = N * \text{Message Length} / 0.1\text{second}$$

Similar to the Maximum Transmission Time, Duty Cycle is represented as a chart in Annex 4. "DR" and "CC" are the parameters which affect Duty Cycle the most at this point. The rest of parameters are such that we have the highest theoretical Duty Cycle possible (note that in real life it will be considerably less than the values shown). As you can see, we achieve the maximum of 0.71 for "DR2" which is 9,600bps and "CC"=26.

Annex 1

Message format :



Pmbi = 700 ms preamble
 SYNC = 23 synchronization bits, transmitted only if SM=Y
 SC = 2 byte system code, transmitted only if TS=Y
 UD = user definable data, number of bytes is set by CC
 CRC = 2 byte CRC, transmitted only if EC=Y
 FLG = message flags, transmitted if TF=Y; it has 1 byte if HF=N and 2 bytes if HF=Y
 KEY = message key, transmitted only if EN=Y

Parameters :

DR	2,3,4	Data Rate: 9600, 19200, 38400 kBits/s
IP	1..200	Number of messages in the package
RC	0..255	Number of extra messages
SD	1..220	Subsequent Delay
SM	Y/N	Synchronous Mode
TF	Y/N	Transmit Flags
HF	Y/N	Hex Flags
TS	Y/N	Transmit System Code
EC	Y/N	Error Check
CC	0..32	Character Count for user data
ID	0..200	Initial Delay
EN	Y/N	Encryption Enable

TxBytes	= SC + UD + CRC + FLG + KEY	- number of bytes per message
BitsPerByte	= 12 for DR4, = 11 for DR3, = 10 for DR2	- number of bits per byte
TxBits	= SYNC + BitsPerByte * TxBytes	- number of bits per message
BitLen	= 1 / DR	- bit duration
TxLen	= 0.0007 + TxBits * BitLen	- message length
InterMsgUnit	= (UD+FLG)*0.0003066 (for DR4), *0.0005657 (DR3), *0.0010996 (DR2)	- time constant

InterMsgDelay	= [SD + RND(0..31)] * InterMsgUnit	Delay between messages
TotalTx	= IP + RC	Maximum number of transmitted messages
N	= TotalTx mod 32	
M	= (TotalTx - N) / 32	
TxTime	= (IP+RC) * TxLen + (IP+RC-1)* InterMsgDelay	Total transmission time

		SD																																	CC																																														
		1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	77	79	81	83	85	87	89	91	93	95	97	99																														
1	261	236	220	202	192	175	167	158	147	140	134	130	122	116	111	107	104	101	98	94	90	87	84	82	79	77	75	73	72	70	69	67	66	65	62	61	59	58	57	55	54	53	52	51	50	49	48	47	46																																
2	201	183	168	157	143	136	130	119	112	107	102	99	94	88	84	81	78	75	73	71	69	67	65	64	60	58	57	55	53	52	51	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3	165	148	137	129	116	108	103	99	92	86	81	77	74	72	69	67	65	61	59	56	54	52	51	49	48	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0									
4	138	129	113	106	100	93	85	80	76	72	69	67	65	60	57	54	52	50	48	47	45	44	43	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																
5	118	107	101	92	83	78	73	70	67	65	59	55	53	50	48	46	45	43	42	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																					
6	104	98	86	78	74	70	67	62	57	53	50	48	46	44	42	41	40	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																									
7	97	83	76	71	68	65	57	53	50	47	45	43	41	40	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																												
8	82	75	70	66	60	54	50	47	45	43	41	39	38	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																															
9	75	70	66	58	52	49	46	43	41	39	38	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																																	
10	71	66	58	52	48	45	42	40	38	37	35	34	33	32	31	29	27	26	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																																						
11	67	59	52	47	44	42	39	38	36	35	33	31	29	27	26	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																																									
12	65	52	47	44	41	39	37	36	34	33	30	28	26	25	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																																											
13	54	48	44	41	39	37	36	34	33	29	27	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																																												
14	50	45	42	39	37	36	34	33	29	27	25	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																																														
15	47	43	40	38	36	34	33	29	26	24	23	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																																																
16	44	41	38	36	34	33	29	26	24	23	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																																																	
17	42	39	37	35	33	30	26	24	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																																																		
18	40	38	36	34	31	27	24	23	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																																																			
19	39	37	35	33	28	25	23	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																																																				
20	38	36	34	30	26	23	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																																																					
21	37	35	33	27	24	22	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																																																						
22	36	34	29	25	22	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																																																							
23	35	33	27	23	21	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																																																								
24	34	30	25	22	20	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																																																									
25	33	27	23	21	19	18	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																																																										
26	33	25	22	20	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																																																										
27	30	24	21	19	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																																																											
28	27	22	20	18	17	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																																																												
29	25	21	19	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																																																												
30	23	20	18	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																																																													
31	22	19	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																																																													
32	21	18	17	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																																																														

Maximum allowable number of messages (IP + RC) that can be transmitted in 5 seconds

DR= 2

SM = Y, TF = Y, HF = Y, TS = Y, EC = Y, EN = Y

Annex 2

CC	SD	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	77	79	81	83	85	87	89	91	93	95	97	99							
		72	68	64	55	50	47	44	42	40	39	37	36	35	34	33	30	29	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1			
1		72	68	64	55	50	47	44	42	40	39	37	36	35	34	33	30	29	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1			
2		53	48	44	41	39	37	36	34	33	30	28	26	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	
3		43	40	37	35	34	31	28	25	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1						
4		37	35	33	29	26	23	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1
5		34	31	25	22	20	19	18	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1				
6		28	23	20	19	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1						
7		22	19	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1								
8		18	17	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1
9		16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	
10		14	13	12	11	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1			
11		13	12	11	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1				
12		12	11	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1					
13		11	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1						
14		10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1							
15		9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1								
16		8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1									
17		8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1									
18		8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1									
19		8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1									
20		7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1										
21		7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1										
22		7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1										
23		6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1											
24		6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1											
25		6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1											
26		6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1											
27		5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1												
28		5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1												
29		5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1												
30		5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1												
31		5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1												
32		5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1	10	9	8	7	6	5	4	3	2	1												

Maximum allowable number of messages (IP + RC) that can be transmitted in 5 seconds

DR = 4 M = Y TF = Y HF = Y TS = Y EC = Y C = 5 EN = Y

RC+IP	SD	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51
10	0.591	0.629	0.668	0.706	0.745	0.784	0.822	0.861	0.9	0.938	0.977	1.015	1.054	1.093	1.131	1.17	1.209	1.247	1.286	1.325	1.363	1.402	1.44	1.479	1.518	1.556	
12	0.697	0.744	0.792	0.839	0.886	0.933	0.98	1.028	1.075	1.122	1.169	1.216	1.264	1.311	1.358	1.405	1.453	1.5	1.547	1.594	1.641	1.689	1.736	1.783	1.83	1.877	
14	0.795	0.851	0.907	0.962	1.018	1.074	1.13	1.186	1.241	1.297	1.353	1.409	1.465	1.52	1.576	1.632	1.688	1.744	1.799	1.855	1.911	1.967	2.023	2.078	2.134	2.19	
16	0.884	0.949	1.013	1.078	1.142	1.206	1.271	1.335	1.399	1.464	1.528	1.593	1.657	1.721	1.786	1.85	1.915	1.979	2.043	2.108	2.172	2.236	2.301	2.365	2.43	2.494	
18	0.965	1.038	1.111	1.184	1.257	1.33	1.403	1.476	1.549	1.622	1.695	1.768	1.841	1.914	1.987	2.06	2.133	2.206	2.279	2.352	2.425	2.498	2.57	2.643	2.716	2.789	
20	1.037	1.119	1.2	1.282	1.364	1.445	1.527	1.608	1.69	1.771	1.853	1.934	2.016	2.098	2.179	2.261	2.342	2.424	2.505	2.587	2.668	2.75	2.832	2.913	2.995	3.076	
22	1.101	1.191	1.281	1.371	1.461	1.552	1.642	1.732	1.822	1.912	2.002	2.092	2.183	2.273	2.363	2.453	2.543	2.633	2.723	2.814	2.904	2.994	3.084	3.174	3.264	3.354	
24	1.166	1.255	1.363	1.462	1.551	1.65	1.748	1.847	1.946	2.044	2.143	2.242	2.341	2.439	2.538	2.637	2.736	2.834	2.933	3.032	3.13	3.229	3.328	3.427	3.525	3.624	
26	1.202	1.31	1.417	1.524	1.632	1.739	1.846	1.954	2.061	2.168	2.275	2.383	2.49	2.597	2.705	2.812	2.919	3.027	3.134	3.241	3.349	3.456	3.563	3.67	3.778	3.886	
28	1.24	1.356	1.472	1.588	1.704	1.82	1.936	2.051	2.167	2.283	2.399	2.515	2.631	2.747	2.863	2.979	3.095	3.21	3.326	3.442	3.558	3.674	3.79	3.906	4.022	4.138	
30	1.269	1.394	1.518	1.643	1.767	1.892	2.016	2.141	2.265	2.39	2.514	2.639	2.763	2.888	3.012	3.137	3.261	3.386	3.51	3.635	3.759	3.884	4.008	4.132	4.257	4.381	
32	1.219	1.348	1.477	1.606	1.734	1.863	1.992	2.121	2.249	2.378	2.507	2.636	2.765	2.893	3.022	3.151	3.28	3.408	3.537	3.666	3.795	3.924	4.052	4.181	4.31	4.439	
34	1.369	1.506	1.643	1.781	1.918	2.056	2.193	2.33	2.468	2.605	2.742	2.88	3.017	3.154	3.292	3.429	3.566	3.704	3.841	3.979	4.116	4.253	4.391	4.528	4.665	4.803	
36	1.51	1.656	1.801	1.947	2.093	2.239	2.385	2.531	2.677	2.823	2.969	3.115	3.261	3.407	3.553	3.699	3.845	3.991	4.137	4.282	4.428	4.574	4.72	4.868	5.012	5.158	
38	1.642	1.796	1.951	2.105	2.255	2.418	2.581	2.744	2.907	3.07	3.234	3.397	3.56	3.723	3.886	4.049	4.212	4.375	4.538	4.702	4.865	5.028	5.191	5.354	5.517	5.683	
40	1.766	1.929	2.092	2.255	2.418	2.581	2.744	2.907	3.07	3.234	3.397	3.56	3.723	3.886	4.049	4.212	4.375	4.538	4.702	4.865	5.028	5.191	5.354	5.517	5.683	5.843	
42	1.881	2.052	2.224	2.396	2.567	2.739	2.911	3.083	3.254	3.426	3.598	3.769	3.941	4.113	4.284	4.456	4.628	4.799	4.971	5.143	5.315	5.486	5.658	5.83	6.001	6.173	
44	1.987	2.167	2.348	2.528	2.708	2.889	3.069	3.249	3.429	3.61	3.79	3.97	4.151	4.331	4.511	4.691	4.872	5.052	5.232	5.413	5.593	5.773	5.953	6.134	6.314	6.494	
46	2.085	2.274	2.463	2.652	2.841	3.029	3.218	3.407	3.596	3.785	3.974	4.163	4.352	4.54	4.729	4.918	5.107	5.296	5.485	5.674	5.863	6.052	6.241	6.43	6.618	6.807	
48	2.174	2.372	2.569	2.767	2.964	3.162	3.359	3.557	3.754	3.952	4.149	4.346	4.544	4.741	4.939	5.136	5.333	5.53	5.729	5.926	6.123	6.321	6.518	6.716	6.913	7.111	
50	2.255	2.461	2.667	2.873	3.079	3.285	3.491	3.697	3.904	4.11	4.316	4.522	4.728	4.934	5.14	5.346	5.552	5.758	5.964	6.17	6.376	6.582	6.788	6.994	7.2	7.406	
55	2.42	2.647	2.875	3.102	3.33	3.557	3.785	4.012	4.24	4.467	4.695	4.922	5.15	5.377	5.608	5.832	6.06	6.287	6.515	6.742	6.97	7.197	7.425	7.652	7.88	8.107	
60	2.53	2.779	3.028	3.277	3.526	3.775	4.024	4.273	4.522	4.771	5.02	5.269	5.518	5.767	6.016	6.265	6.514	6.763	7.012	7.261	7.509	7.758	8.007	8.256	8.505	8.754	
65	2.585	2.851	3.117	3.384	3.65	3.916	4.182	4.448	4.714	4.98	5.246	5.513	5.779	6.045	6.311	6.577	6.843	7.109	7.376	7.642	7.908	8.174	8.44	8.706	8.972	9.238	
70	2.932	3.22	3.507	3.795	4.082	4.37	4.658	4.945	5.233	5.52	5.808	6.095	6.383	6.671	6.958	7.246	7.534	7.822	8.109	8.396	8.684	8.971	9.259	9.547	9.834	10.12	
75	3.225	3.534	3.843	4.152	4.461	4.77	5.079	5.388	5.696	6.007	6.316	6.625	6.934	7.243	7.552	7.861	8.17	8.479	8.788	9.097	9.406	9.715	10.02	10.33	10.64	10.95	
80	3.465	3.795	4.126	4.456	4.787	5.117	5.448	5.778	6.109	6.439	6.77	7.1	7.431	7.761	8.092	8.422	8.753	9.083	9.414	9.744	10.07	10.41	10.74	11.07	11.4	11.73	
85	3.65	4.002	4.354	4.706	5.058	5.41	5.762	6.114	6.465	6.816	7.167	7.518	7.869	8.22	8.573	8.924	9.275	9.626	9.977	10.328	10.679	11.03	11.38	11.73	12.08	12.43	
90	3.783	4.156	4.529	4.903	5.276	5.649	6.022	6.395	6.768	7.141	7.514	7.887	8.26	8.633	9.006	9.379	9.752	10.125	10.498	10.871	11.244	11.617	11.99	12.362	12.735	13.108	
95	3.861	4.256	4.651	5.046	5.441	5.836	6.231	6.626	7.021	7.416	7.811	8.206	8.601	8.996	9.391	9.786	10.181	10.576	10.971	11.366	11.761	12.156	12.551	12.946	13.341	13.736	
100	4.09	4.502	4.914	5.326	5.738	6.15	6.562	6.974	7.386	7.798	8.211	8.623	9.035	9.447	9.859	10.271	10.683	11.095	11.507	11.919	12.331	12.743	13.155	13.567	13.979	14.391	
105	4.404	4.838	5.272	5.706	6.14	6.574	7.008	7.442	7.876	8.31	8.744	9.178	9.612	10.046	10.48	10.914	11.348	11.782	12.216	12.65	13.084	13.518	13.952	14.386	14.82	15.256	
110	4.665	5.12	5.575	6.03	6.485	6.94	7.398	7.852	8.306	8.76	9.214	9.668	10.122	10.576	11.03	11.484	11.938	12.392	12.846	13.3	13.754	14.208	14.662	15.116	15.57	16.03	
115	4.873	5.349	5.825	6.302	6.778	7.254	7.73	8.206	8.682	9.158	9.634	10.11	10.587	11.063	11.539	12.015	12.491	12.967	13.443	13.919	14.395	14.871	15.347	15.823	16.299	16.775	
120	5.026	5.524	6.022	6.52	7.018	7.514	8.01	8.512	9.014	9.517	10.019	10.521	11.023	11.525	12.027	12.529	13.031	13.533	14.035	14.537	15.039	15.541	16.043	16.545	17.047	17.549	
125	5.125	5.646	6.165	6.684	7.203	7.722	8.241	8.762	9.281	9.801	10.32	10.84	11.36	11.88	12.4	12.92	13.44	13.96	14.48	14.99	15.51	16.03	16.55	17.07	17.59	18.11	

Transmission Time, sec

Annex 4

Duty Cycle : 0.71

SM=Y, TS=Y, SD=1, TF=N, HF=N, EC=Y, EN=Y

CC \ DR				
	2	3	4	
1	0.69	0.63	0.54	D u t y C y c l e
2	0.62	0.53	0.45	
3	0.57	0.52	0.42	
4	0.56	0.49	0.41	
5	0.54	0.46	0.40	
6	0.58	0.49	0.38	
7	0.54	0.44	0.40	
8	0.50	0.47	0.38	
9	0.53	0.49	0.40	
10	0.56	0.43	0.36	
11	0.59	0.44	0.38	
12	0.60	0.47	0.40	
13	0.57	0.49	0.40	
14	0.54	0.51	0.36	
15	0.51	0.49	0.38	
16	0.50	0.46	0.39	
17	0.52	0.44	0.41	
18	0.54	0.45	0.42	
19	0.56	0.47	0.42	
20	0.58	0.49	0.39	
21	0.60	0.50	0.38	
22	0.62	0.52	0.39	
23	0.65	0.54	0.40	
24	0.67	0.56	0.41	
25	0.69	0.57	0.43	
26	0.71	0.56	0.44	
27	0.70	0.54	0.45	
28	0.69	0.52	0.46	
29	0.68	0.51	0.47	
30	0.67	0.49	0.45	
31	0.66	0.47	0.43	
32	0.65	0.46	0.41	
Max Duty Cycle :	0.71	0.63	0.54	

4.4. 20 DB BANDWIDTH @ FCC CFR 47, PARA. 15.209(C)**PRODUCT NAME:** ROLL CAGE TAG, Model No.: TRC95**FCC REQUIREMENTS:**

The 20dB bandwidth of the emission shall be no more than 0.25% of the centre frequency for devices operating above 70MHz.

CLIMATE CONDITION:

Standard Temperature and Humidity:

- Ambient temperature: 23+3 °C
- Relative humidity: 50+5 %
- Atmospheric Pressure: 100+5 kPa

POWER INPUT:

3 Vdc battery.

TEST EQUIPMENT:

- Advantest Spectrum Analyzer, Model R3271, S/N: 15050203

TEST RESULTS: Conforms.

Frequency (MHz)	Measured 20 dB BW (kHz)	Limit (25% Fc) (MHz)
434	120	108.5

TEST PERSONNEL: Hung Trinh, EMI/RFI Technician

DATE: Apr. 22/1999

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Website: <http://www.ultratech-labs.com>

File #: KAS-037FCC15C**Apr. 24, 1999**

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hp

13: 36: 49 JAN 31, 1997 16: 16: 43 JAN 31, 1997

MARKER Δ
-60 KHz
-25.96 dB

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR -60 KHz
-25.96 dB

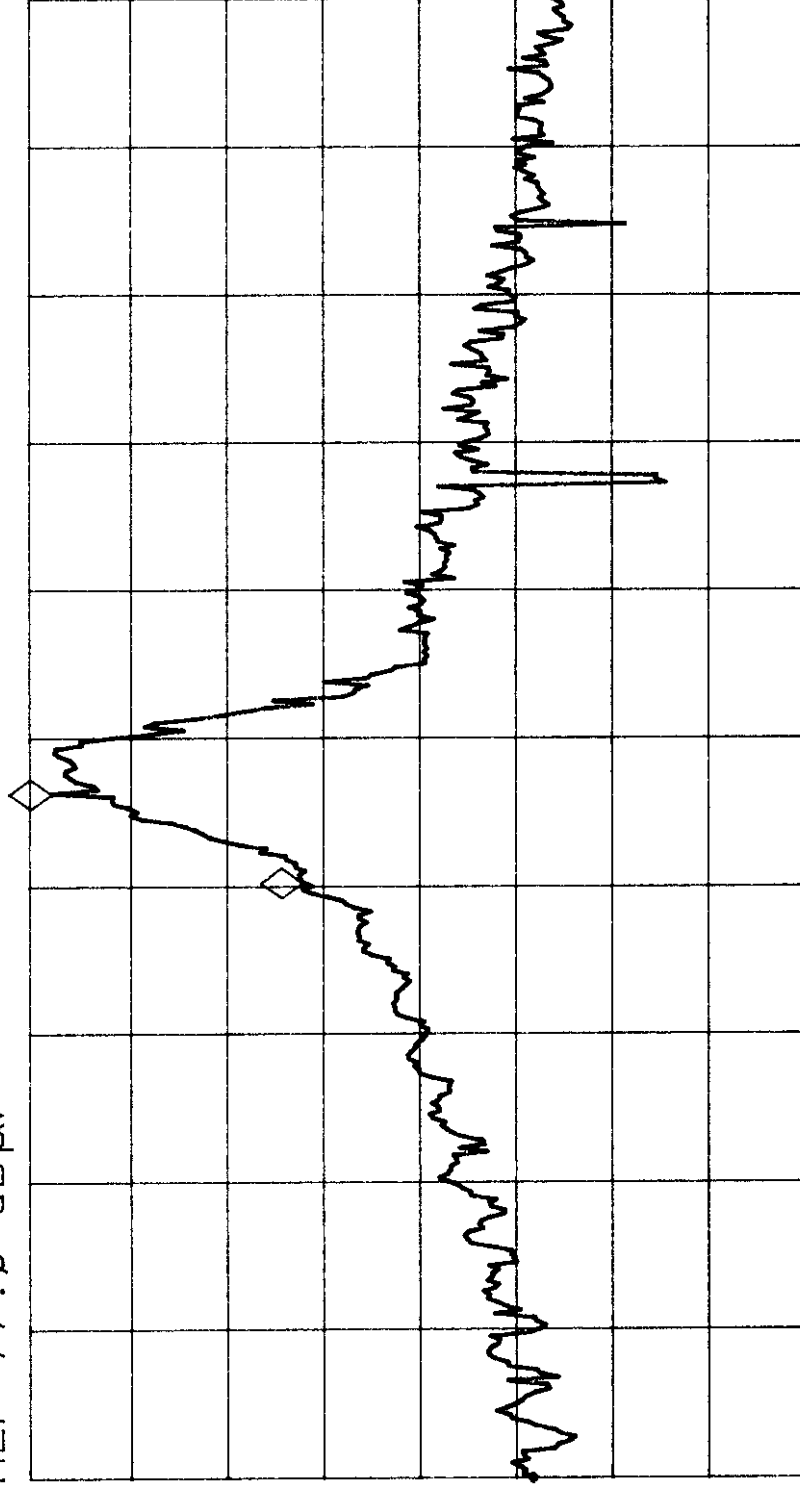
COPY
SCREEN

OUTPUT
REPORT

OBV: 120 KHz

LOG REF 77.0 dB μ V

10
dB/
#ATN
0 dB



VA SB
SC FC
ACORR

Define
Report

Define
List

EDIT
ANNOTATN

CENTER 433.940 MHz
#IF BW 10 KHz

SPAN 1.000 MHz
#AVG BW 100 KHz
#SWP 100 msec

5. EXHIBIT 5 - GENERAL TEST PROCEDURES

5.1. ELECTRICAL FIELD RADIATED EMISSIONS MEASUREMENTS - GENERAL TEST METHOD

- The radiated emission measurements were performed at the Ultratech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario. The Attenuation Characteristics of OFTS have been filed to FCC.
- Radiated emissions measurements were made using the following test instruments:
 1. Calibrated EMCO active loop antenna in the frequency range from 10 KHz to 1 MHz
 2. Calibrated EMCO biconilog antenna in the frequency range from 30 MHz to 2000 MHz.
 3. Calibrated A.H. Systems log periodic antenna in the frequency range above 1000 MHz (1GHz - 18 GHz).
 4. Calibrated Advantest spectrum analyzer and pre-selector. In general, the spectrum analyzer would be used as follows:
 - The rf electric field levels were measured with the spectrum analyzer set to PEAK detector (1 KHz RBW and VBW $\geq$ RBW for frequency below 30 MHz, 100 KHz RBW and VBW $\geq$ RBW for Frequency below 1 GHz and 1 MHz RBW and 1 MHz VBW for frequency greater than 1 GHz).
 - If any rf emission was observed to be a broadband noise, the spectrum analyzer's CISPR QUASI-PEAK detector (120 KHz RBW and 1MHz VBW) was then set to measure the signal level.
 - If the signal being measured was narrowband and the ambient field was broadband, the bandwidth of the spectrum analyzer was reduced.
- The EUT was set-up in its typical configuration and operated in its various modes as described in 3.2 of the test report.
- The frequencies of emissions was first detected. Then the amplitude of the emissions was measured at the specified measurement distance using required antenna height, polarization, and detector characteristics.
- During this process, cables and peripheral devices were manipulated within the range of likely configuration.
- For each mode of operation required to be tested, the frequency spectrum was monitored. Variations in antenna heights (from 1 meter to 4 meters above the ground plane), antenna polarization (horizontal plane and vertical plane), cable placement and peripheral placement (each variable within bounds specified elsewhere) were explored to produce the highest amplitude signal relative to the limit.

The maximum radiated emission for a given mode of operation was found by using the following step-by-step procedure:

Step1: Monitor the frequency range of interest at a fixed antenna height and EUT azimuth.

Step2: Manipulate the system cables to produce highest amplitude signal relative to the limit. Note the amplitude and frequency of the suspect signal.

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- Step3: Rotate the EUT 360 degrees to maximize the suspected highest amplitude signal. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, go back to the azimuth and repeat Step 2. Otherwise, orient the EUT azimuth to repeat the highest amplitude observation and proceed.
- Step4: Move the antenna over its full allowed range of travel (1 to 4 meters) to maximize the suspected highest amplitude signal. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, return to Step 2 with the highest amplitude observation and proceed.
- Step5: Change the polarity of the antenna and repeat Step 2 through 4. Compare the resulting suspected highest amplitude signal with that found for the other polarity. Select and note the higher of the two signals. This signal is termed the highest observed signal with respect to the limit for this EUT operational mode.
- Step6: The effects of various modes of operation is examined. This is done by varying the equipment modes as steps 2 through 5 are being performed.
- Step7: After completing steps 1 through 6, record the final highest emission level, frequency, antenna polarization and detector mode of the measuring instrument.

Calculation of Field Strength:

The field strength is calculated by adding the calibrated antenna factor and cable factor, and subtracting the Amplifier gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where	FS	=	Field Strength
	RA	=	Receiver/Analyzer Reading
	AF	=	Antenna Factor
	CF	=	Cable Attenuation Factor
	AG	=	Amplifier Gain

Example: If a receiver reading of 60.0 dBuV is obtained, the antenna factor of 7.0 dB and cable factor of 1.0 dB are added, and the amplifier gain of 30 dB is subtracted. The actual field strength will be:

$$\begin{aligned} \text{Level in dBuV/m} &= 60 + 7.0 + 1.0 - 30. \\ &= 38.0 \text{ dBuV/m.} \end{aligned}$$

$$\text{Level in uV/m} = 10^{(38/20)} = 79.43 \text{ uV/m.}$$

Notes: The frequency and amplitude of at least six highest conducted emissions relative to the limit are recorded unless such emissions are more than 20 dB below the limit. If less than six emissions are within 20dB of the limit, the background or receiver noise level shall be reported at representative frequencies.

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6. EXHIBIT 6 - INFORMATION RELATED TO EQUIPMENT UNDER TESTS

6.1. FCC ID LABELING AND SKETCH OF FCC LABEL LOCATION

Refer to the attached sheets

6.2. PHOTOGRAPHS OF EQUIPMENT UNDER TEST

Refer to the attached photographs

6.3. SYSTEM BLOCK DIAGRAM(S)

Refer to the attached sheets

6.4. SCHEMATIC DIAGRAMS

Refer to the attached sheets

6.5. USER'S MANUAL WITH "FCC INFORMATION TO USER STATEMENTS"

Refer to the attached Users' manual

ULTRATECH GROUP OF LABS

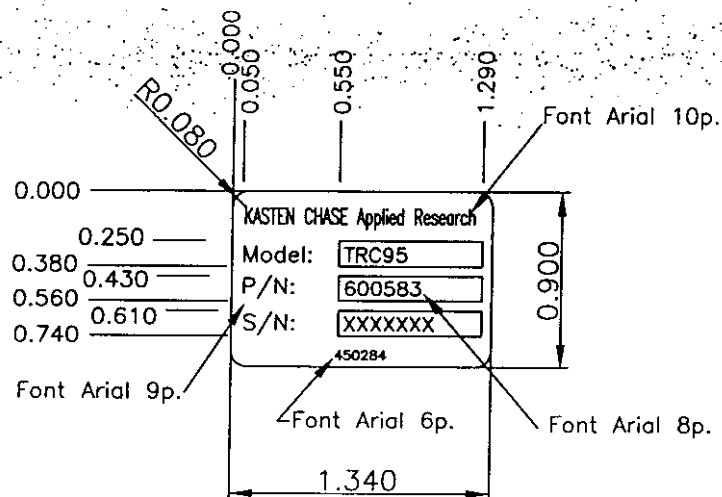
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

Tel. #: 905-829-1570, Fax. #: 905-829-8050, Website: <http://www.ultratech-labs.com>

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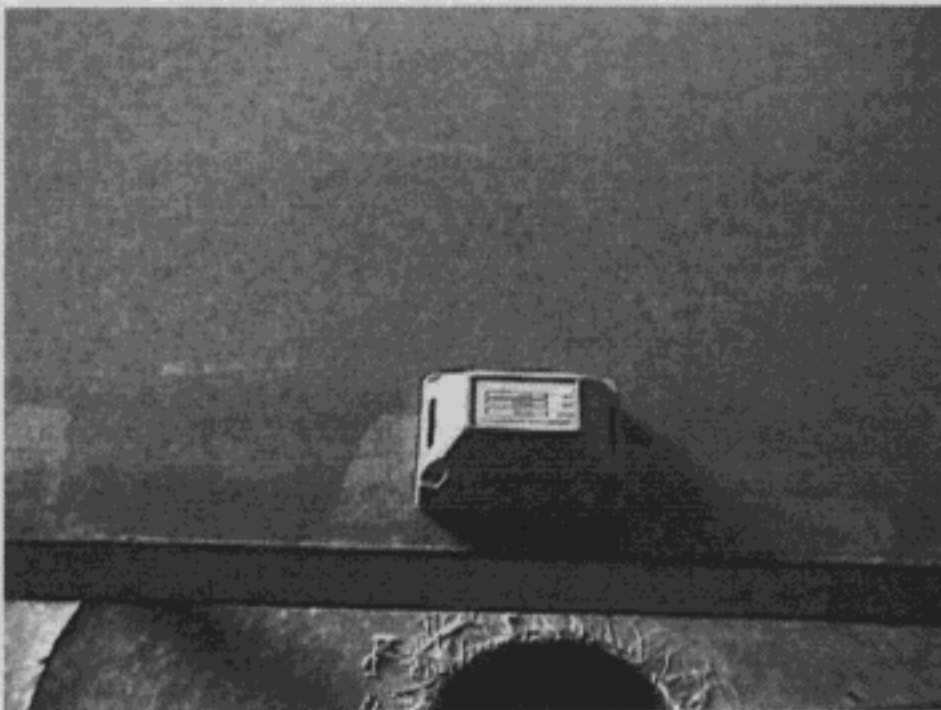
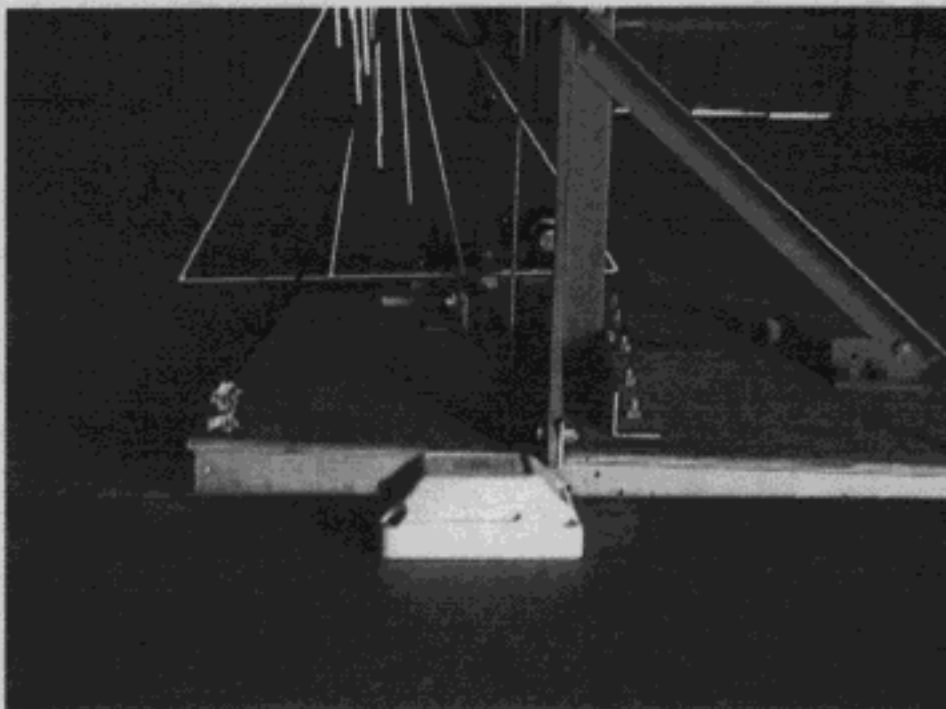
NOTE (Unless otherwise specified):

1. All dimensions are in inches.
2. Tolerance: ± 0.010 .
3. For printing use black color, font Arial or Helvetica
4. Use blank label 2-5/8" x 1", LABELON, type BD-330.

					KASTEN CHASE Applied Research		TITLE Label SN/APRV,TRC95			
					DSG	LDEN	18MAR99	PART NO	DWG NO	REV
					CHK	MPAU	18MAR99	450284	950251	---
REV	ECO NO	BY	CHK	DATE				SCALE	SIZE	SHEET 1 OF 1
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3.2. PHOTOGRAPH FOR RF EMISSION MEASUREMENTS

Tests were performed at the Open Field test Site located in Oakville, Ontario, Canada.



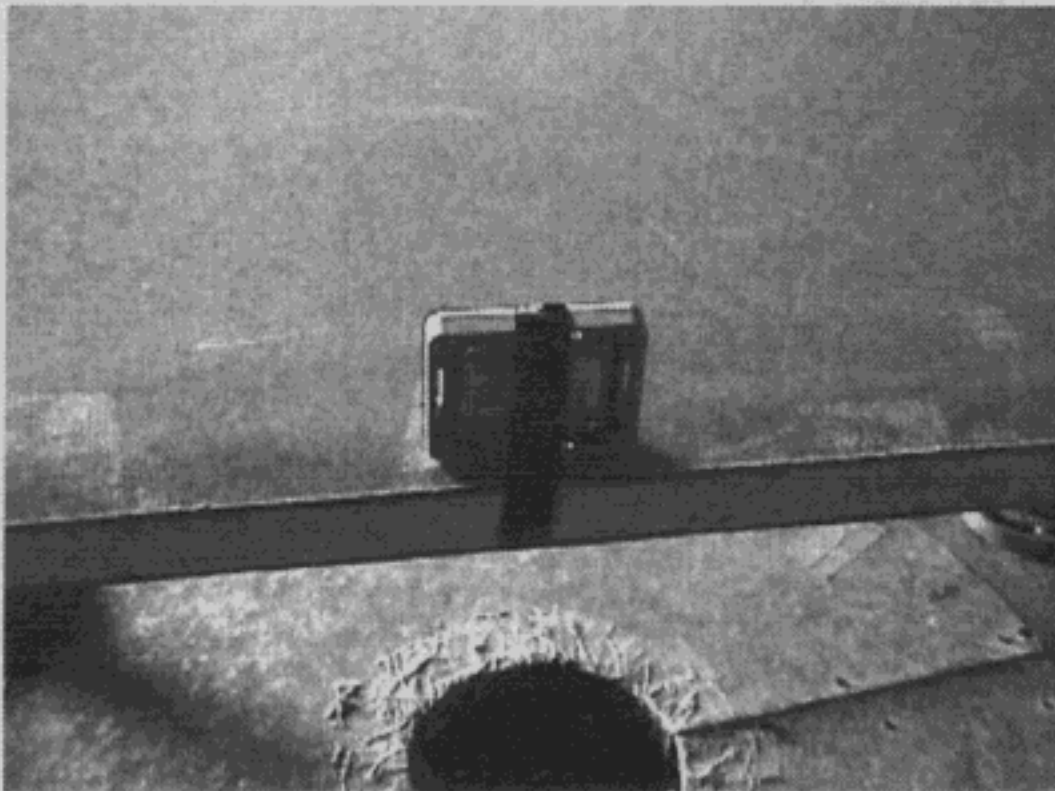
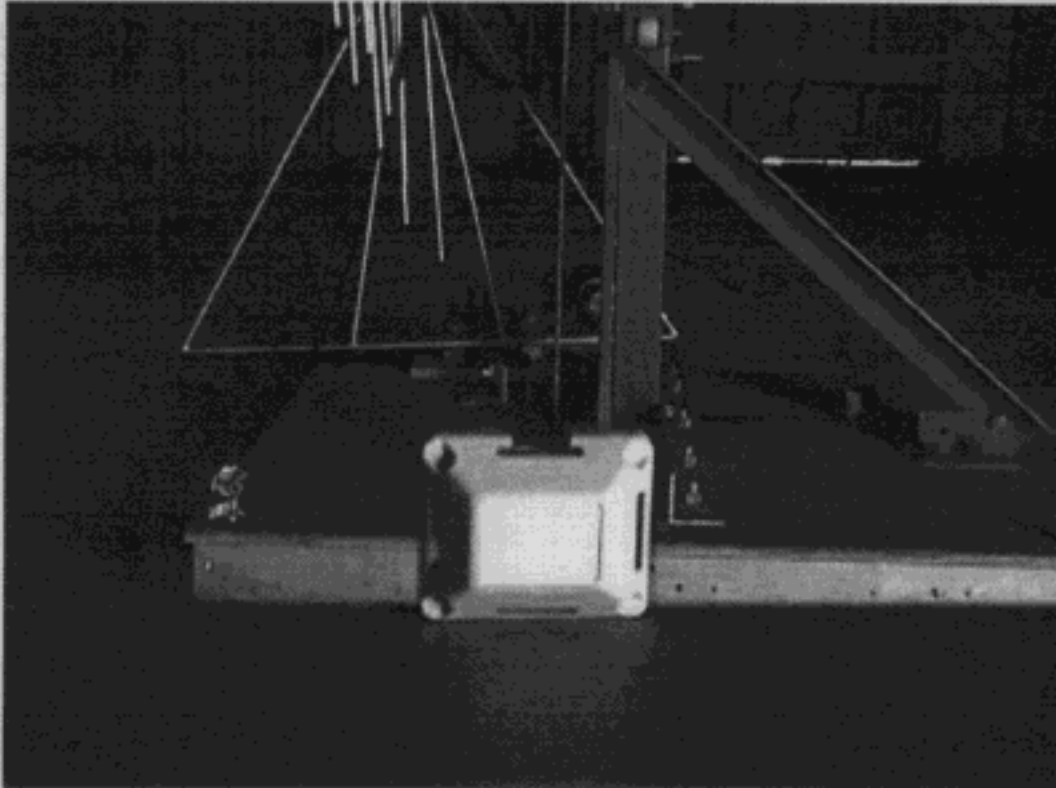
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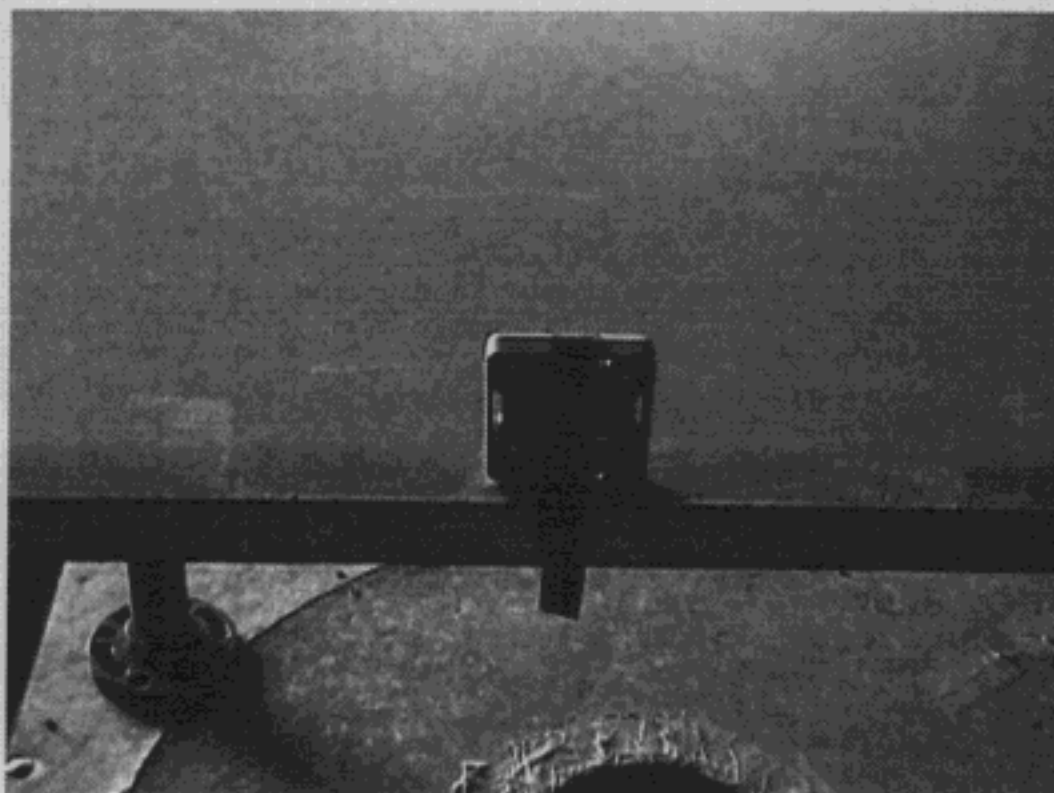
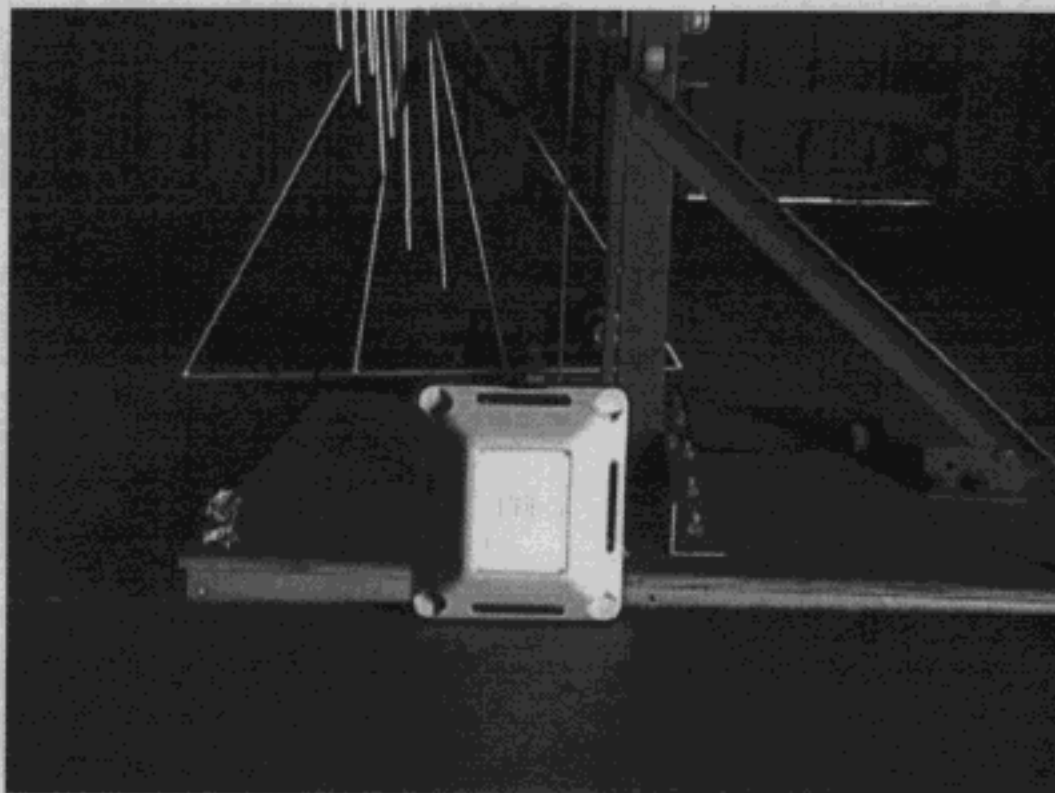
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