

INTERTEK TESTING SERVICES

MEASUREMENT/TECHNICAL REPORT

TMC (H.K.) Ltd. - MODEL: TMC WCID-B1000
FCC ID: NT4-WCIDB1000

August 19, 1998

This report concerns (check one):		Original Grant <u>X</u>	Class II Change _____
Equipment Type: <u>Low Power Transmitter</u> (example: computer, printer, modem, etc.)			
Deferred grant requested per 47 CFR 0.457(d)(1)(ii)?		Yes _____	No <u>X</u>
If yes, defer until:		_____ date	
Company Name agrees to notify the Commission by:		_____ date	
of the intended date of announcement of the product so that the grant can be issued on that date.			
Transition Rules Request per 15.37?		Yes _____	No <u>X</u>
If no, assumed Part 15, Subpart C for intentional radiator - the new 47 CFR [10-1-96 Edition] provision.			
Report prepared by:	C. K. Lam Intertek Testing Services 2/F., Garment Center, 576, Castle Peak Road, HONG KONG Phone: 852-2746-8218 Fax: 852-2785-5487		

INTERTEK TESTING SERVICES

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EXHIBIT 1

GENERAL DESCRIPTION

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1.0 General Description

1.1 Product Description

The Equipment Under Test (EUT) is a transmitter portion of a wireless caller ID system operating at 480 MHz. The EUT is powered by an AC/DC adaptor. The internal power supply's isolation is accomplished through a power transformer having an adequate dielectric rating. The circuit wiring is consistent under the requirement of part 68. When a call comes in, the EUT automatically displays the caller ID information and also transmits the identical information to a wireless caller ID remote unit periodically. The transmission period is 0.85 second and the silent period is 28 seconds.

The brief circuit description is attached in the following pages.

1.2 Related Submittal(s) Grants

This is a single application for certification of a transmitter. The FCC ID of the receiver associated with this transmitter is NT4-WCID-R1000.

Technical Description

WCID-B1000

This model is a caller display unit with transmit capability. It receives standard Bellcore Type I caller ID data and transmit the same at carrier frequency of 480 Mhz to any receiver (WCID-R1000) placed within around 100m circle.

The F201 10 ohm fusible resistor and the VAR201 300V varistor forms the protection circuit for the tip and ring.

The FSK data is decoded by U203 EM92547B and the data is then passed to the U201 HD404888/4889 CPU. After interpreting the data, the CPU will output the data to the LCD.

The record is stored in the non-volatile memory U202 24C16 for further review. 60 records maximum can be stored.

The data is sent to the receiver via radio frequency (RF) means. The DATAOUT pin is normal high. When it turns to low, the 480 Mhz oscillator formed by C15, IFT2, Q2, Q3 will send out the carrier frequency.

The C10 - C15, L3 - L5 forms a high rejection filter to attenuate the higher harmonics.

Z201, Z202, R214, C218, D201, U204 and R235 forms the ringer voltage detector.

D202 - D205, R215 - R217, C219 and Q203 forms the loop detector. When the line is in use, LDET goes low.

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1.3 Test Methodology

Both AC mains line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.4 (1992). All measurements were performed in Open Area Test Sites. Preliminary scans were performed in the Open Area Test Sites only to determine worst case modes. For each scan, the procedure for maximizing emissions in Appendices D and E were followed. All Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application.

1.4 Test Facility

The open area test site and conducted measurement facility used to collect the emission data is located at Garment Centre, 576 Castle Peak Road, Kowloon, Hong Kong. This test facility and site measurement data have been fully placed on file with the FCC.

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EXHIBIT 2

SYSTEM TEST CONFIGURATION

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2.0 System Test Configuration

2.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in C63.4 (1992). The worst case bit sequence was applied during test.

The EUT was powered from AC/DC adaptor..

For maximizing emissions, the EUT was rotated through 360°, the antenna height was varied from 1 meter to 4 meters above the ground plane, and the antenna polarization was changed. This step by step procedure for maximizing emissions led to the data reported in Exhibit 3.0.

The unit was operated standalone and placed in the center of the turntable.

For simplicity of testing, the unit was wired to transmit continuously.

2.2 EUT Exercising Software

There was no special software to exercise the device. Once the button is depressed, the unit transmits the typical signal. For simplicity of testing, the unit was wired to transmit continuously.

2.3 Special Accessories

There are no special accessories necessary for compliance of this product.

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2.4 Equipment Modification

Any modifications installed previous to testing by TMC (H.K.) Ltd. will be incorporated in each production model sold/leased in the United States.

No modifications were installed by Intertek Testing Services.

2.5 Support Equipment List and Description

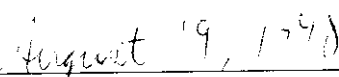
This product was tested in a standalone configuration.

All the items listed under section 2.0 of this report are

Confirmed by:

C. K. Lam
Assistant Manager
Intertek Testing Services
Agent for TMC (H.K.) Ltd.

_____
Signature

_____
Date

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EXHIBIT 3

EMISSION RESULTS

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3.0 Emission Results

Data is included worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

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3.1 Field Strength Calculation

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below.

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

where FS = Field Strength in dB μ V/m

RA = Receiver Amplitude (including preamplifier) in dB μ V

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB

AG = Amplifier Gain in dB

PD = Pulse Desensitization in dB

AV = Average Factor in -dB

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:

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

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3.1 Field Strength Calculation (cont)

Example

Assume a receiver reading of 62.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted. The pulse desensitization factor of the spectrum analyzer was 0 dB, and the resultant average factor was -10 dB. The net field strength for comparison to the appropriate emission limit is 32 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

$$RA = 62.0 \text{ dB}\mu\text{V}$$

$$AF = 7.4 \text{ dB}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$PD = 0 \text{ dB}$$

$$AV = -10 \text{ dB}$$

$$FS = 62 + 7.4 + 1.6 - 29 + 0 + (-10) = 32 \text{ dB}\mu\text{V/m}$$

$$\text{Level in mV/m} = \text{Common Antilogarithm} [(32 \text{ dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m}$$

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3.3 Radiated Emission Data

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Judgement: Passed by 4.2 dB

TEST PERSONNEL:



Signature

Ken C. C. Lam, Compliance Engineer
Typed/Printed Name

August 19, 1998
Date

INTERTEK TESTING SERVICES

Company: TMC (H.K.) Ltd.
Model: TMC WCID-B1000

Date of Test: August 14, 1998

Table 1

Radiated Emissions

Polarity	Frequency (MHz)	Reading (dB μ V)	Antenna Factor (dB)	Pre-Amp Gain (dB)	Average Factor (-dB)	Net at 3m (dB μ V/m)	Limit at 3m (dB μ V/m)	Margin (dB)
H	480.324	71.8	26.0	16.0	12	69.8	74.0 ✓	-4.2
H	*960.525	32.3	26.0	16.0	12	42 30.3	54.0	-23.7
H	*1440.875	42.4	25.5	34.0	12	21.9	54.0	-32.1
H	1921.148	59.2	26.5	34.0	12	39.7	54.0	-14.3
H	2401.286	42.8	29.1	34.0	12	25.9	54.0	-28.1
H	*2881.654	48.5	29.1	34.0	12	31.6	54.0	-22.4

Q.P.K. Limit

Notes: 1. Peak Detector Data unless otherwise stated.

2. All measurements were made at 3 meter. Harmonic emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.

3. Negative value in the margin column shows emission below limit.

4. Horn antenna and average detector are used for the emission over 1000MHz.

*Emission within the restricted band meets the requirement of part 15.205. The corresponding limit as per 15.209 is based on Quasi peak detector data for frequencies below 1000 MHz and average detector data for frequencies over 1000 MHz.

Test Engineer: Ken C. C. Lam

INTERTEK TESTING SERVICES

Company: TMC (H.K.) Ltd.
Model: TMC WCID-B1000

Date of Test: August 14, 1998

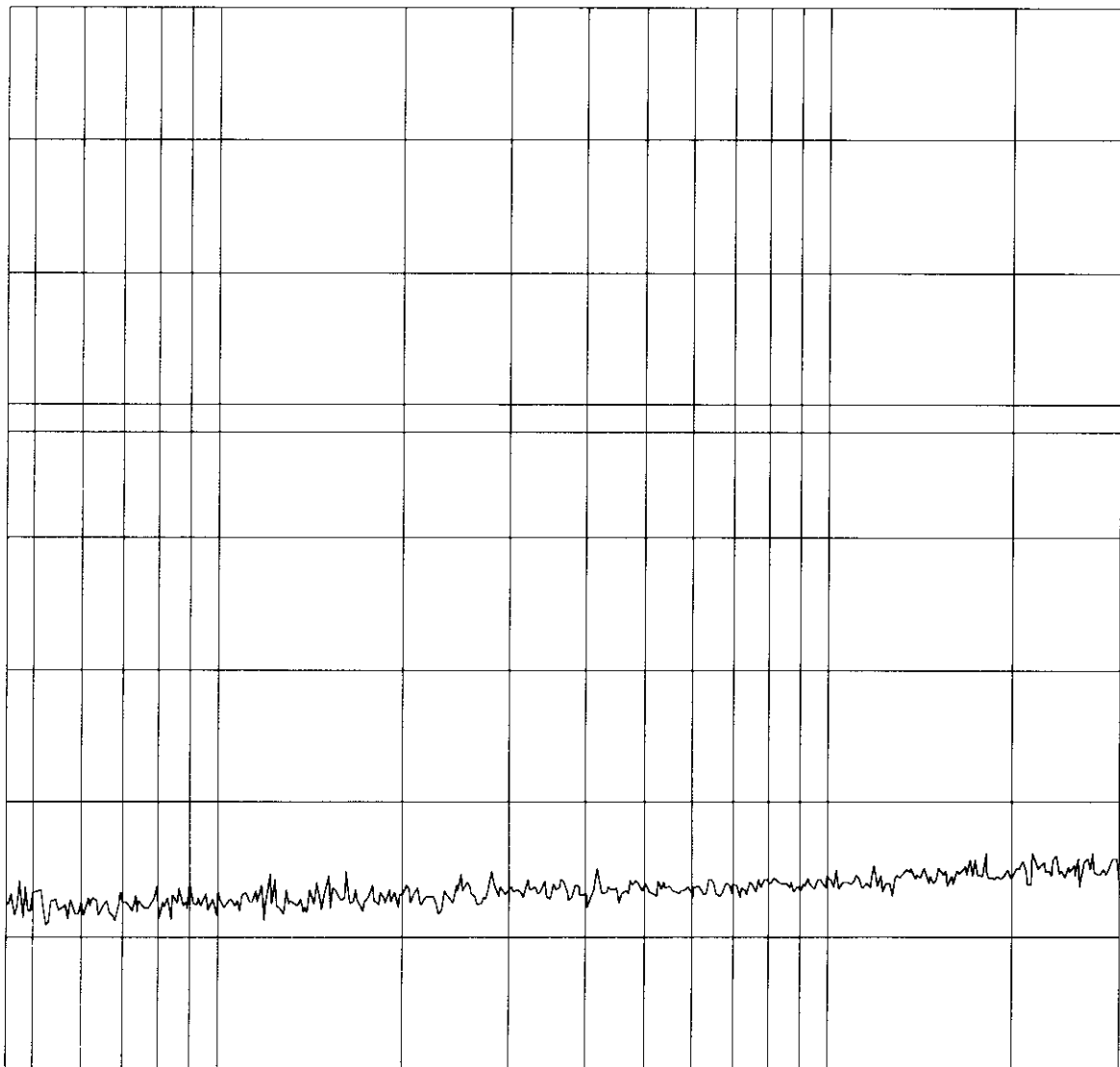
Graph 1

Conducted Emissions
Section 15.107 Requirements

Report No.: 7-00140

Customer: [illegible]
Project: [illegible]
Sample: [illegible]
Test: [illegible]
Date: [illegible]
By: [illegible]
Title: [illegible]
Location: [illegible]
Notes: [illegible]
Remarks: [illegible]
Drawings: [illegible]
References: [illegible]
Attachments: [illegible]
Signatures: [illegible]
Date: [illegible]

10.0



10.0

10.0

10.0

Ctrl. No.: N/A

File ID: NT4-WC1DB1000

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Company: TMC (H.K.) Ltd.
Model: TMC WCID-B1000

Date of Test: August 14, 1998

Table 2

Conducted Emissions
Section 15.107 Requirements

Report No.: *1761140*

Tested By: Hong, Report No.: 996084

Scan Settings: All Range

----- Frequencies -----			----- Receiver Settings -----					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
40.74	100	1k	10k	PK	30ms	AUTO	IN OFF	60dB

Final Measurement Results:

no Results

Ctrl. No.: *N/A*

FCC ID: N14-WC-DB1000

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3.5 Line Conducted Emission Configuration Data

The data on the following page lists the significant emission frequencies, the limit, and the margin of compliance.

Judgement: Passed by more than 20 dB margin.

* All readings are peak unless stated otherwise.

TEST PERSONNEL:



Signature

Ken C. C. Lam, Compliance Engineer
Typed/Printed Name

August 19, 1998
Date

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EXHIBIT 8

MISCELLANEOUS INFORMATION

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8.0 Miscellaneous Information

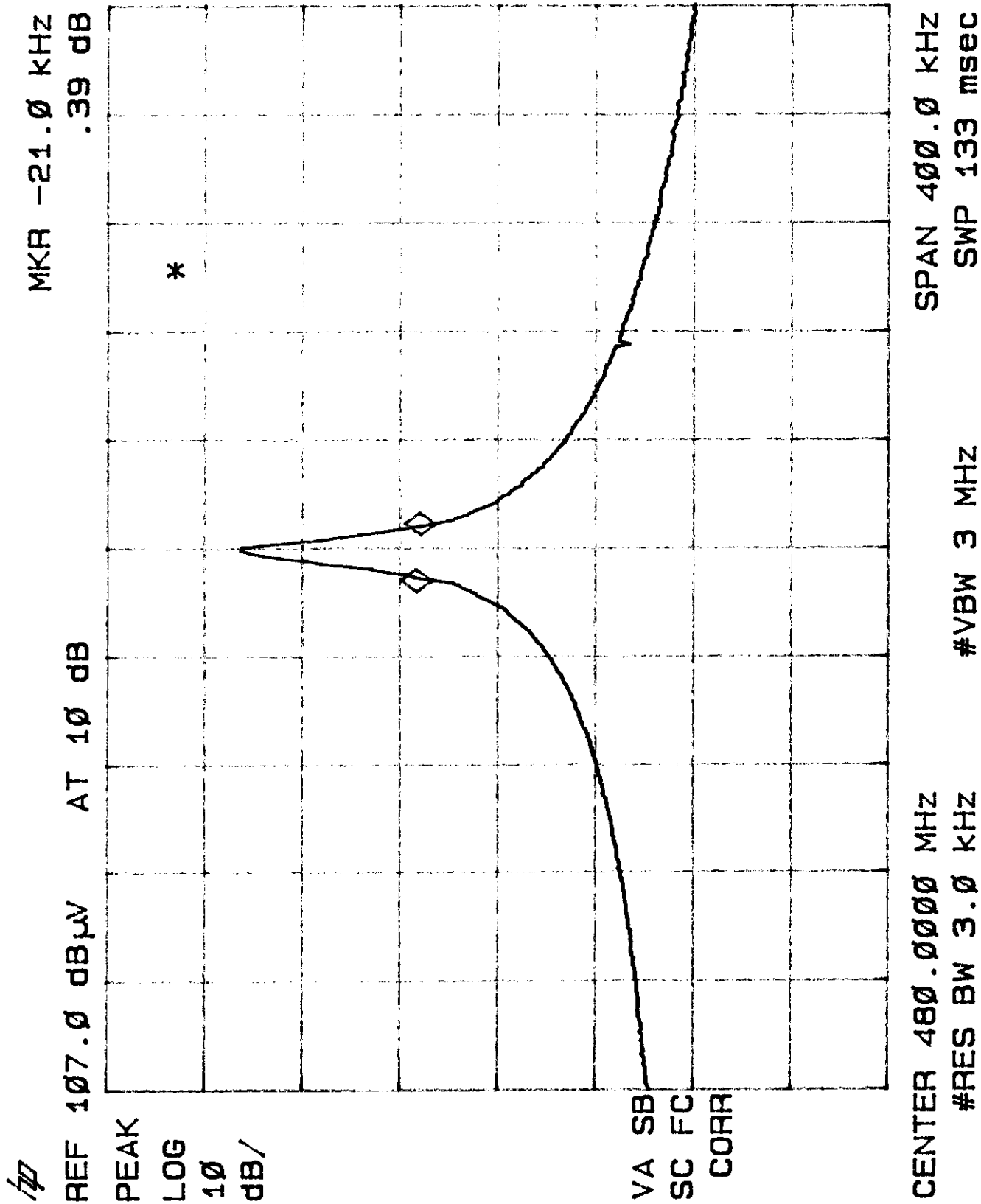
This miscellaneous information includes details of the measured bandwidth, the test procedure and calculation of factors such as pulse desensitization and averaging factor.

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8.1 Measured Bandwidth

The plot on the following page shows the fundamental emission when modulated. From the plot, the bandwidth is observed to be 21 kHz, at 20 dBc. The bandwidth limit is 1200 kHz. Therefore, the unit meets the requirement of Section 15.231(c).

Figure 8.1 Bandwidth



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8.2 Discussion of Pulse Desensitization

The determination of pulse desensitivity was made in accordance with Hewlett Packard Application Note 150-2, *Spectrum Analysis ... Pulsed RF*.

Pulse desensitivity was not applicable for this device. The effective period (T_{eff}) was approximately 0.4 ms for a digital "1" bit, as shown in the plots of Exhibit 8.3. With a resolution bandwidth (3 dB) of 100 kHz, the pulse desensitivity factor was 0 dB.

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8.3 Calculation of Average Factor

Averaging factor in dB = $20 \log (\text{duty cycle})$

The specification for output field strengths in accordance with the FCC rules specify measurements with an average detector. During testing, a spectrum analyzer incorporating a peak detector was used. Therefore, a reduction factor can be applied to the resultant peak signal level and compared to the limit for measurement instrumentation incorporating an average detector.

The time period over which the duty cycle is measured is 100 milliseconds, or the repetition cycle, whichever is a shorter time frame. The worst case (highest percentage on) duty cycle is used for the calculation. The duty cycle is measured by placing the spectrum analyzer in zero scan (receiver mode) and linear mode at maximum bandwidth (3 MHz at 3 dB down) and viewing the resulting time domain signal output from the analyzer on a Tektronix oscilloscope. The oscilloscope is used because of its superior time base and triggering facilities.

A plot of the worst-case duty cycle as detected in this manner, timing of data transmission and description of data protocol format are included in the following page.

The duty cycle is simply the on-time divided by the period:

The duration of one cycle = 100 ms
Effective period of the cycle = $(0.4 \times 63)\text{ms}$
= 25.2ms

DC = $25.2\text{ms} / 100\text{ms} = 0.252$ or 25.2%

Therefore, the averaging factor is found by $20 \log_{10} 0.252 = -12 \text{ dB}$

A plot of the worst-case duty cycle

hp

REF 117.0 dBμV AT 20 dB

PEAK

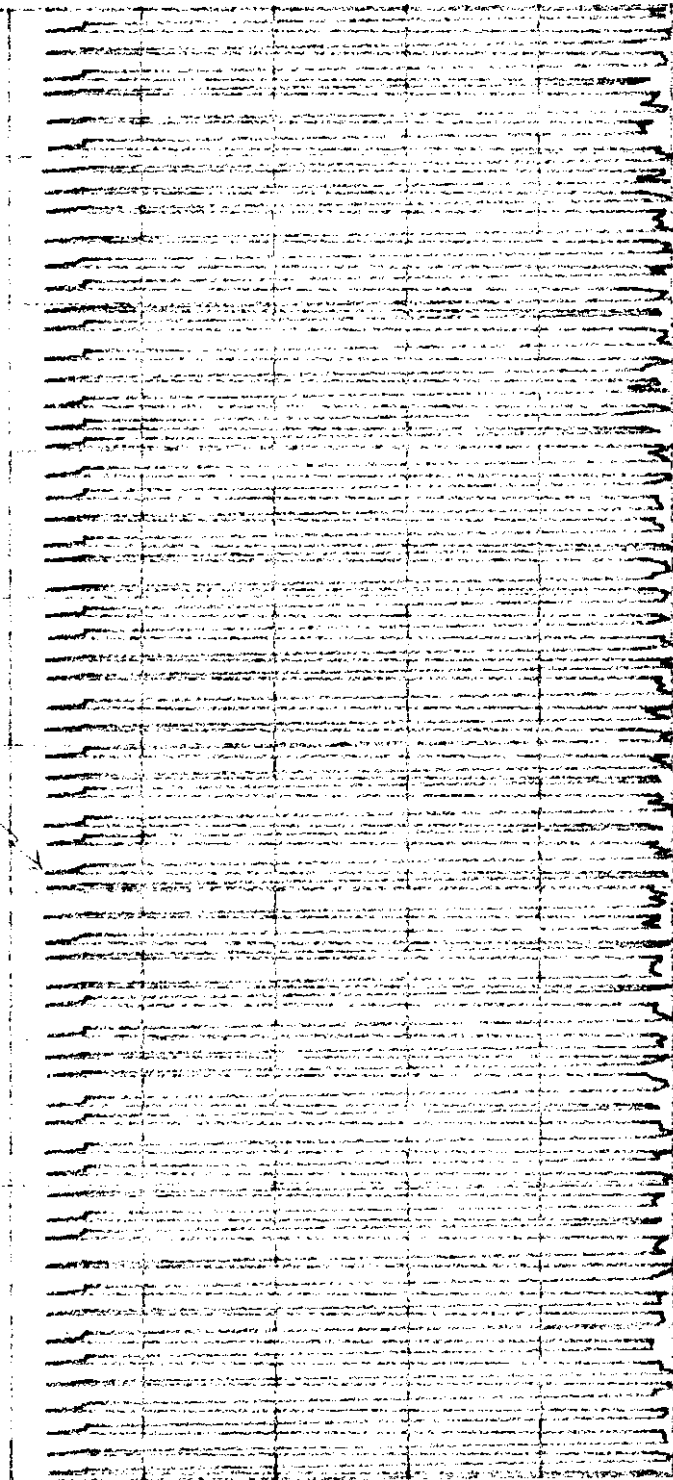
LOG

10

dB/

0.4 mV

*



VA SB

SC FC

COHR

CENTER 480.0000 MHz

#RES BW 3.0 MHz

#VBW 3 MHz

#SWP 100 msec

SPAN 0 Hz

Mode: Incoming Call

Timing of Data Transmission

hp

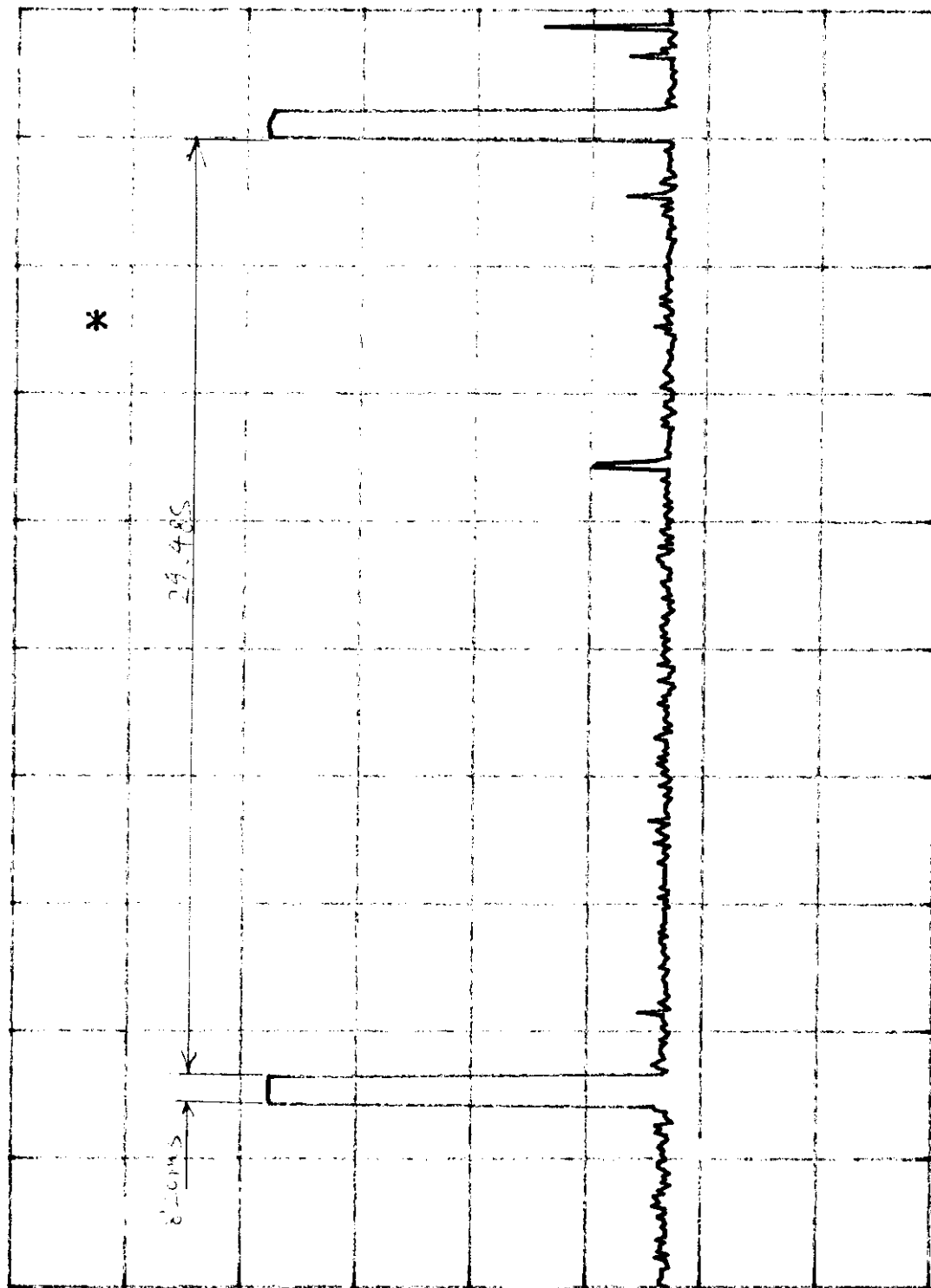
REF 117.0 dBμV AT 20 dB

PEAK

LOG

10

dB/

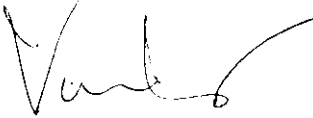


CENTER 480.000 MHz
#RES BW 3.0 MHz

SPAN 0 Hz
#SWP 40.0 sec

#VBW 3 MHz

To : Mr. Ken Lam - ITS
Fm : Terence Fong - TMC / HK
Date : 13 Aug 98



CONFIDENTIAL

Subj. : Update Data Protocol for Wireless Caller ID Base Transmitter

In the data transmission, "zero" means the presence of the 480MHz carrier and "one" means no carrier.

400 microseconds bit time ("zero") and a $\frac{1}{4}$ duty cycle data protocol have been selected, i.e. the time with the presence of the carrier frequency is 25% of the overall data packet.

For example, the data channel seizure signal is in the form of 0111011101110111 01110111.

Each data packet has been limited to be 0.85 second. And no periodic data packet is to be sent within 28 seconds.

For example, when the user press the PAGE button, the base transmitter sends out the first data packet and wait for 28 seconds before sending the second data packet to complete the page cycle.

END OF DOCUMENT

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8.4 Emissions Test Procedures

The following is a description of the test procedure used by Intertek Testing Services in the measurements of transmitters operating under Part 15, Subpart C rules.

The test set-up and procedures described below are designed to meet the requirements of ANSI C63.4 - 1992.

The transmitting equipment under test (EUT) is attached to a cardboard box and placed on a wooden turntable which is four feet in diameter and approximately one meter in height above the ground plane. During the radiated emissions test, the turntable is rotated and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The cardboard box is adjusted through all three orthogonal axes to obtain maximum emission levels. The antenna height and polarization are varied during the testing to search for maximum signal levels.

Detector function for radiated emissions is in peak mode. Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings. A detailed description for the calculation of the average factor can be found in Exhibit 8.3.

The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower. For line conducted emissions, the range scanned is 450 kHz to 30 MHz.

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8.4 Emissions Test Procedures (cont'd)

The EUT is warmed up for 15 minutes prior to the test.

AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new, fully charged battery is used.

Conducted measurements are made as described in ANSI C63.4 - 1992.

The IF bandwidth used for measurement of radiated signal strength was 100 kHz or greater below 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. A discussion of whether pulse desensitivity is applicable to this unit is included in this report (See Exhibit 8.2). Above 1000 MHz, a resolution bandwidth of 1 MHz is used.

Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the forbidden bands and above 1 GHz, signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling, but those measurements taken at a closer distance are so marked.