

TEST REPORT

Applicant Name : Chili Technology LLC
& Address 144 Talbert Pointe Drive Suite 103 Mooresville, NC 28117,USA

Sample Description
Product : Remote Controller
Model No. : CP Cube remote
Electrical Rating : 3V DC(2 x AAA 1.5V Battery)
FCC ID : 2ABA9-CP-CUBE-02

Date Received : 14 October 2013

Date Test Conducted : 14 October 2013 –17 December 2013

Test standards : FCC Part 15:2011

Test Result : Pass
Conclusion : The submitted samples complied with the above rules/standards.
Remark : None.

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1 General Description

1.1 Product Description

The equipment under test (EUT) is a controller for Electric heating and cooling mattress at 433.92 MHz. The EUT is powered by 3V DC.

During normal use, it sends the signal to control the on/off and working status / temperature change of Electric heating and cooling mattress by manual.

Antenna Type: PCB antenna.

1.2 Related Submittal(s) Grants

The FCC ID of corresponding receiver Electric heating and cooling mattress for this transmitter is 2ABA9-CP-CUBE-01.

1.3 Test Methodology

Radiated emission measurements were performed according to the procedures in ANSI C63.10 (2009). Radiated Emission measurement was performed in a Semi-anechoic chamber. Preliminary scans were performed in the Semi-anechoic chamber only to determine worst case modes. For each scan, the procedure for maximizing emissions in clause 6.5 & 6.6 of ANSI C63.10 (2009) were followed. All Radiated tests were performed at an antenna to EUT distance of 3 meters unless stated otherwise.

1.4 Test Facility

All of the tests are performed at:

Intertek Testing Services Shenzhen Ltd. Guangzhou Branch. Block E, No.7-2
Guang Dong Software Science Park, Caipin Road, Guangzhou Science City,
GETDD Guangzhou, China. This test facility and site measurement data have
been fully placed on file with the FCC, test firm registration number is 549654.

2 System Test Configuration

2.1 *Justification*

The equipment under test (**EUT**) was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in ANSI C63.10 (2009).

The EUT was operated standalone and placed in the center of the turntable, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes. For maximizing emission at and above 30 MHz, 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 of clause 3.3 in the report.

2.2 *EUT Exercising Software*

There was no special software to exercise the device.

2.3 *Special Accessories*

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

2.4 *Equipment Modification*

Any modifications installed previous to testing by Chili Technology LLC will be incorporated in each production model sold/leased in the United States. No modifications were installed by Intertek Testing Services Shenzhen Ltd. Guangzhou Branch.

2.5 *Measurement Uncertainty*

When determining the test conclusion, the Measurement Uncertainty of test has been considered.

2.6 *Support Equipment List and Description*

N/A

3 Radiated 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.

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.

$$\begin{aligned} \text{FS} &= \text{RA} + \text{AF} + \text{CF} - \text{AG} + \text{PD} + \text{AV} \\ \rightarrow \quad \text{FS} &= \text{RA} + \text{Correct Factor} + \text{AV} \end{aligned}$$

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

Correct Factor = AF + CF - AG + PD

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:

$$\text{FS} = \text{RA} + \text{AF} + \text{CF} - \text{AG} + \text{PD} + \text{AV}$$

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 dB μ V

AF = 7.4 dB

CF = 1.6 dB

AG = 29.0 dB

PD = 0 dB

AV = -10 dB

$$\text{Correct Factor} = 7.4 + 1.6 - 29.0 + 0 = -20 \text{ dB}$$

$$\text{FS} = 62 + (-20) + (-10) = 32 \text{ dB}\mu\text{V}/\text{m}$$

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

3.2 Radiated and Spurious Emission Data

The following data shows the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.
Judgement: Passed by 5.49 dB at 867.84MHz.

Test mode: transmitting mode

Radiated Emissions Pursuant to FCC 15.231(a): Emissions Requirement

Below 1GHz

Polarization	Frequency (MHz)	QP Reading (dB μ V)	Correction Factor (dB)	QP Net at 3m (dB μ V/m)	QP Limit at 3m (dB μ V/m)	QP Margin (dB)
Horizontal	51.098	8.03	13.30	21.33	40.00	-18.67
Horizontal	98.143	8.58	12.22	20.80	43.50	-22.70
Horizontal	325.365	9.74	16.70	26.44	46.00	-19.56
Vertical	43.095	7.59	13.80	21.39	40.00	-18.61
Vertical	103.963	8.22	12.55	20.77	43.50	-22.73
Vertical	298.933	8.44	15.5	23.94	46.00	-18.76

Polarization	Frequency (MHz)	Peak Reading (dB μ V)	Correction Factor (dB)	Peak Net at 3m (dB μ V/m)	AV Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	433.76	50.60	18.70	69.30	80.80	-24.06
Horizontal	867.84	29.19	26.12	55.31	60.80	-5.49
Vertical	433.76	43.93	18.70	62.63	80.80	-18.17
Vertical	867.84	19.98	26.12	46.10	60.80	-11.84

Radiated Emissions
Pursuant to FCC 15.231(a): Emissions Requirement**Above 1GHz**

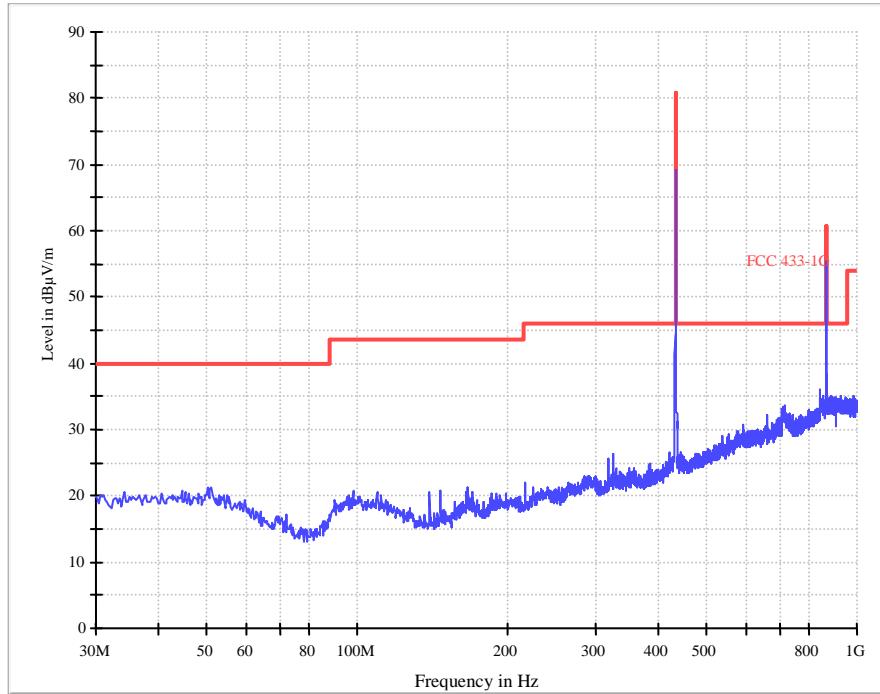
Polarization	Frequency (MHz)	Peak Reading (dB μ V)	Correction Factor (dB)	Peak Net at 3m (dB μ V/m)	AV Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	1301.63	13.45	28.00	41.45	54.00	-12.55
Horizontal	1735.38	9.06	30.70	39.76	54.00	-14.24
Horizontal	2169.13	4.00	32.40	36.40	54.00	-17.60
Horizontal	2603.25	4.66	33.90	38.56	54.00	-15.44
Horizontal	3470.50	2.01	36.30	38.31	54.00	-15.69
Vertical	1301.50	18.43	28.00	46.43	54.00	-7.57
Vertical	1735.75	12.31	30.70	43.01	54.00	-10.99
Vertical	2169.00	11.73	32.40	44.13	54.00	-9.87
Vertical	2603.25	10.27	33.90	44.17	54.00	-9.83
Vertical	3036.75	7.04	36.10	43.14	54.00	-10.86

Notes:

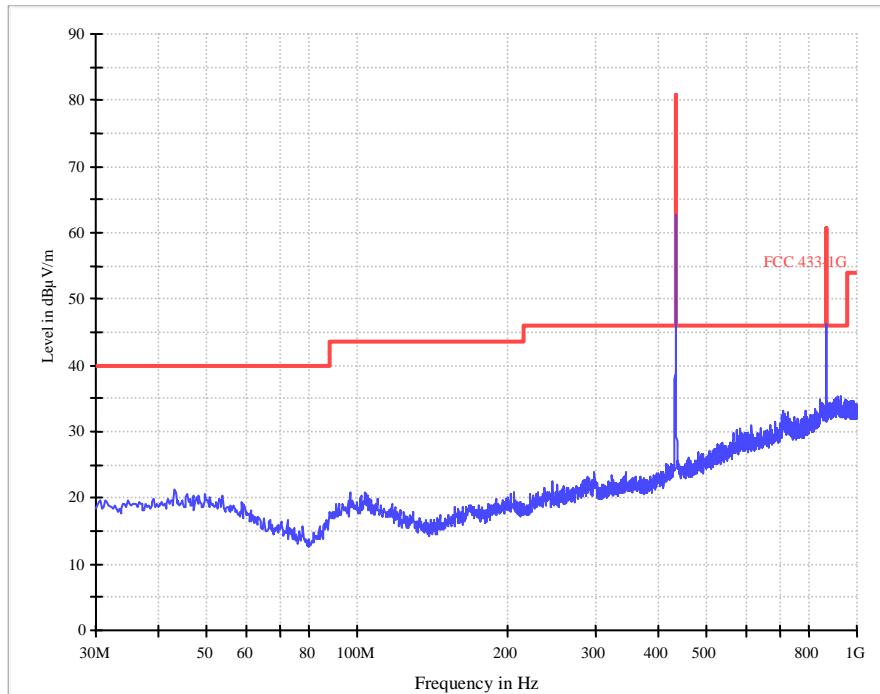
1. For fundamental and spurious below 1GHz, Peak detector was used;
Other emissions below 1GHz, QP detector was used.
For above 1GHz: Peak detector was used.
2. All measurements were made at 3 meter.
3. Negative value in the margin column shows emission below limit.
4. Horn antenna is used for the emission over 1000MHz.

Test Curve below 1GHz :

Horizontal:



Vertical:

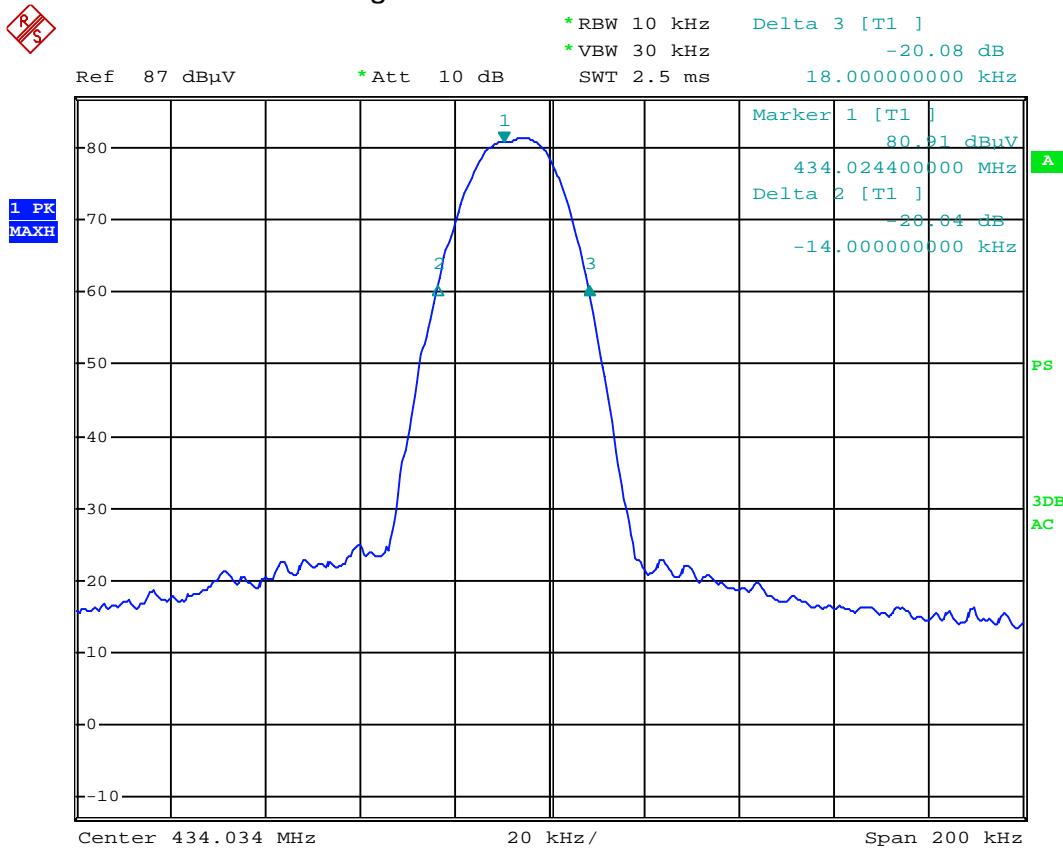


4 Bandwidth and Timing

This miscellaneous information includes details of the measured bandwidth and Timing plot.

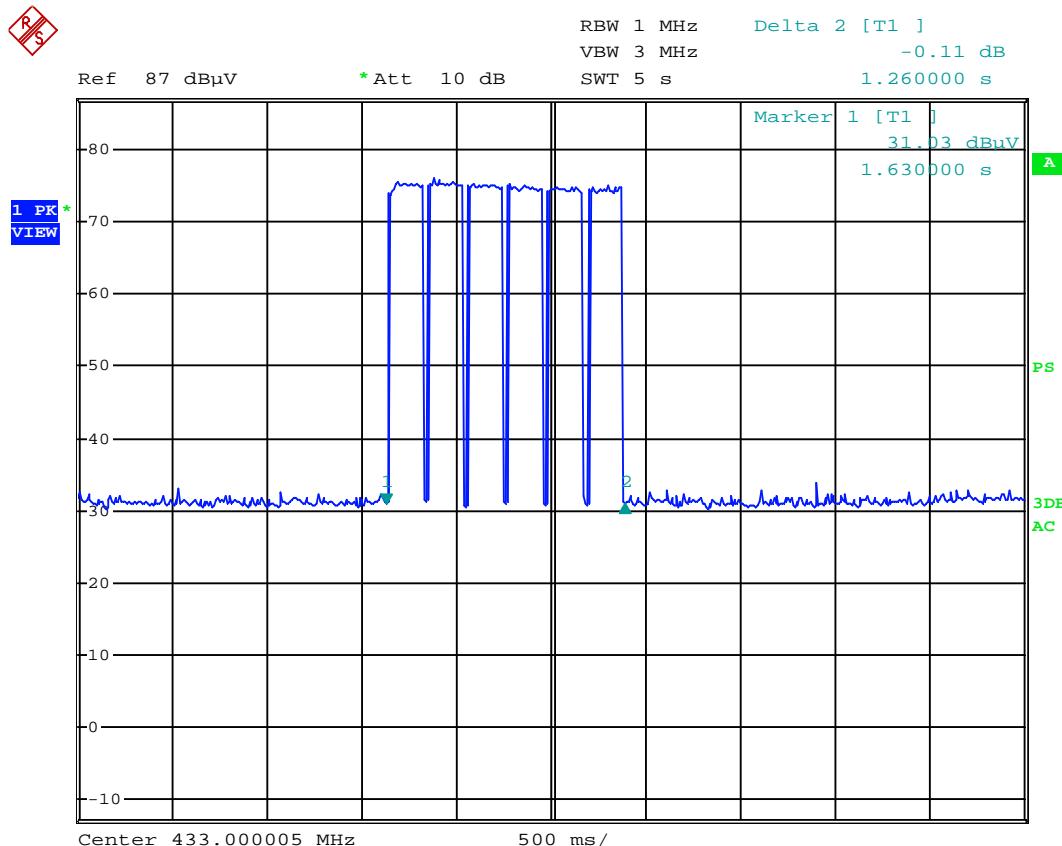
4.1 Bandwidth Plot

The test method is according clause 6.9 of ANSI C63.10: 2009



The plot shows the fundamental emission when modulated. From the plot, the bandwidth is observed to be 32.0kHz at 20 dB where the bandwidth limit is $434.024 \times 0.0025 = 1.08\text{MHz}$.

4.2 Timing Plot



The plot shows the fundamental emission when modulated.

From the plot, the active timing is observed to be 1.2600s, where required by clause 15.231 of FCC Part 15: “A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.” The product is deemed to fulfill the requirement.

4.3 Calculation of Average Factor

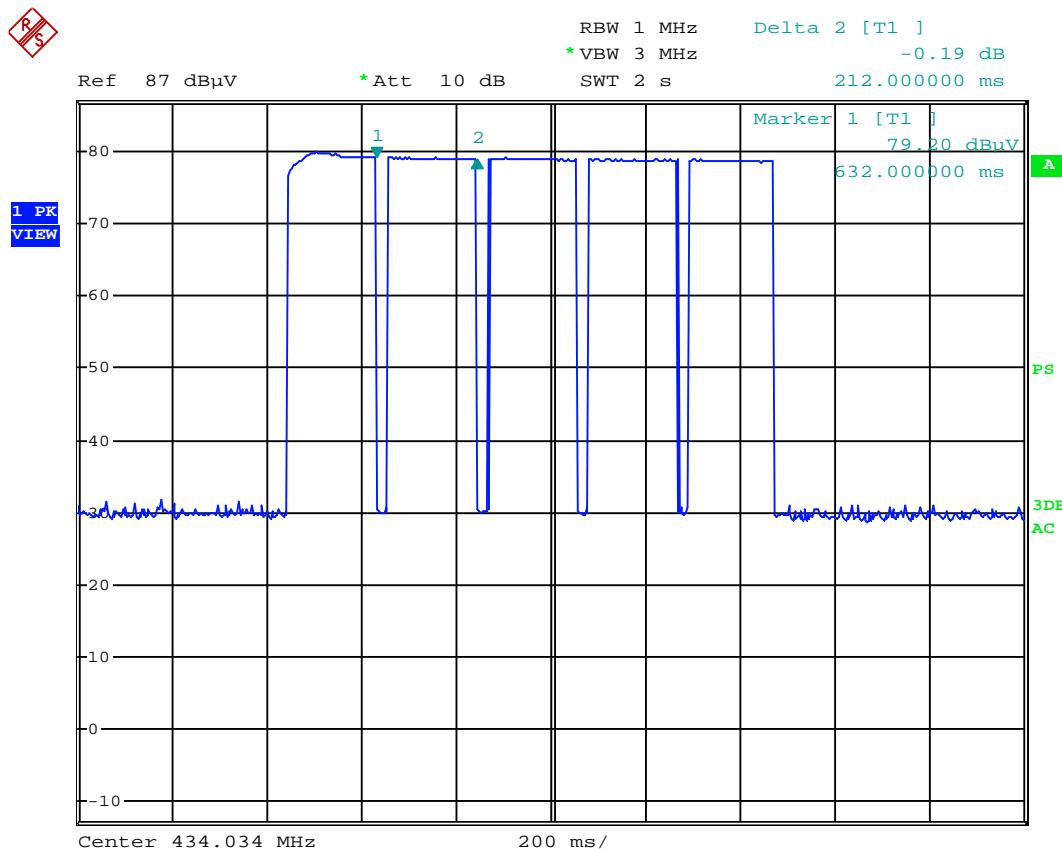
Averaging factor in dB = $20 \log (\text{duty cycle})$

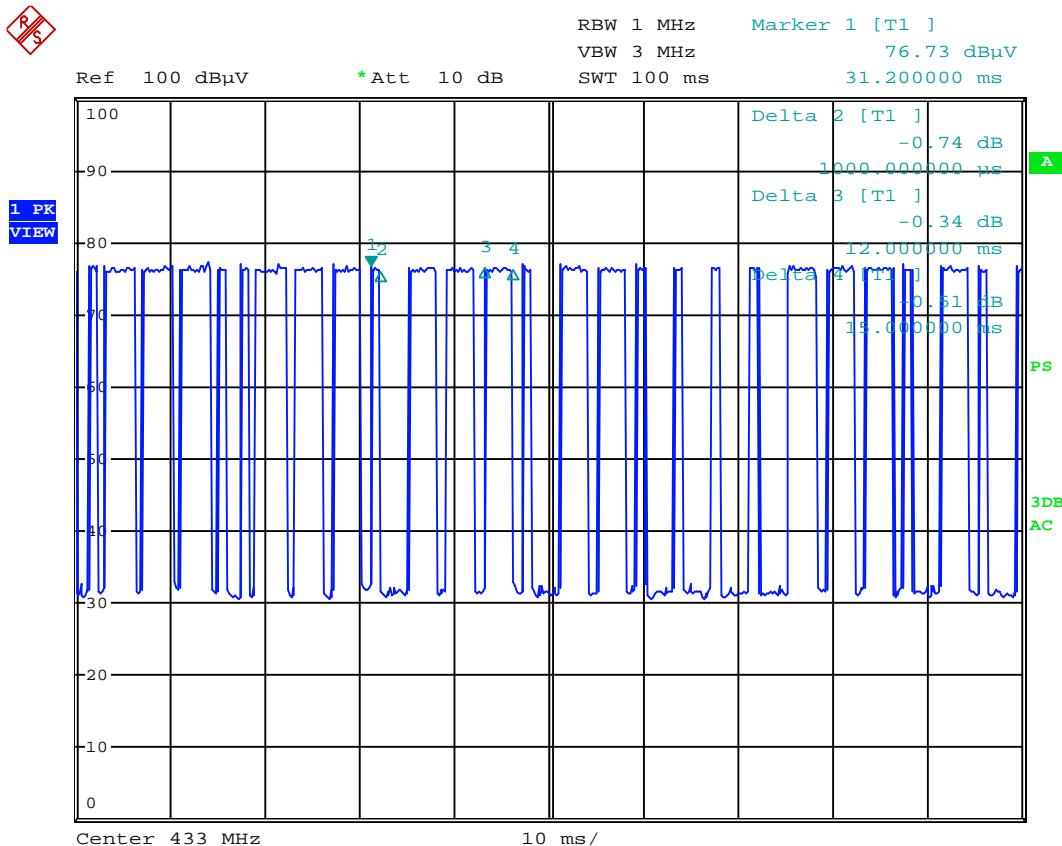
The specification for output field strengths in accordance with the FCC rules specify measurements with an average detector. During testing, a spectrum analyzer incorporating a peak detector was used. Therefore, a reduction factor

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 is shown below.





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

The duration of one cycle =212 ms
 Effective period of the cycle = 57ms

DC = $57/212=0.2689$ or 26.89%

Therefore, the averaging factor is found by $20\lg 0.2689=-11.4$

4.4 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 C63.10 : 2009.

The transmitting equipment under test (EUT) is 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 EUT 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 4.3 of the report.

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.

4.5 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.

The IF bandwidth used for measurement of radiated signal strength was 10 kHz for emission below 30 MHz and 120 kHz for emission from 30 MHz to 1000 MHz. Where transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. Above 1000 MHz, a resolution bandwidth of 1 MHz is used.

Transmitter measurements are normally conducted at a measurement distance of three meters.

5 Equipment list

Equipment No.	Equipment	Manufacturer	Model No.	Cal. Date	Due Date
EM031-02	EMI Test Receiver	R&S	R&S ESR7	03-Jun-2013	03-Jun-2014
EM061-03	Bilog Antenna	SCHWARZBECK	VULB 9161	25-May-2013	25-May-2014
EM031-02-01	Coaxial cable	R&S	/	03-Jun-2013	03-Jun-2014
EM031-03	Spectrum Analyzer	R&S	R&S FSV40	03-Jun-2013	03-Jun-2014
EM033-02	Horn Antenna	R&S	R&S HF907	25-May-2013	25-May-2014
EM031-02-01	Coaxial cable	R&S	/	03-Jun-2013	03-Jun-2014
EM080-05	EMI receiver	R&S	ESCI	26-Oct-2013	26-Oct-2014
EM033-02-01	Signal Amplifier	R&S	R&S SCU-18	25-May-2013	25-May-2014