

TEST REPORT

1. Applicant

Name : KPC, Inc.
Address : #830, Research Center for Industry Co-Operation, Dong-A Univ 840, Hadan2-Dong, Saha-Gu, Busan 604-714, Korea

2. Products

Name : UHF Band RFID Tag (Low power transceiver – RX verified)
Model/Type : KT901
Manufacturer : KPC, Inc.

3. Test Standard/Method : FCC Part 15, Subpart C

4. Test Results : Positive

5. Use of Report : -

6. Date of Application : March 05, 2007

7. Date of Issue : March 12, 2007

Tested by



Sung-Kyu Cho

Telecommunication Team
Engineer

Approved by



Seok-Jin Kim

Telecommunication Team
Manager

The test results contained apply only to the test sample(s) supplied by the applicant, and this test report shall not be reproduced in full or in part without approval of the KTL in advance.

Korea Testing Laboratory

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I . GENERAL INFORMATIONS

1.1 Applicant (Client)

| | |
|----------------|---|
| Name | KPC, Inc. |
| Address | #830, Research Center for Industry Co-Operation, Dong-A Univ 840, Hadan2-Dong, Saha-Gu, Busan 604-714, Korea |
| Contact Person | Hyun-chul, Kim |
| Telephone No. | + 82-51-203-2512 |
| Facsimile No. | + 82-51-203-2513 |
| E-mail address | hckim@kpcnet.com |

1.2 Equipment (EUT)

| | |
|----------------------|---|
| Type of equipment | UHF Band RFID Tag (Low power transceiver – RX verified) |
| Model Name | KT901 |
| FCC ID | T5A-KT901 |
| Tunning Frequency | 433.92 MHz |
| Modulation | Frequency Shift Keying |
| IF frequency | 307.2 kHz |
| Data rate | 27.8 Kbps |
| Air protocol | ISO/IEC 18000-7 |
| Standard | FCC Part 15, Subpart C |
| Measuring Procedure | ANSI C63.4-2003 |
| Manufacturer Name | KPC, Inc. |
| Manufacturer Address | #830, Research Center for Industry Co-Operation, Dong-A Univ 840, Hadan2-Dong, Saha-Gu, Busan 604-714, Korea |

1.3 Testing Laboratory

| | |
|------------------|---|
| Testing Place | Korea Testing Labortory (KTL) 222-13 Guro-dong, Guro-Gu, Seoul 152-848 Korea |
| Test Engineer | Sungkyu Cho |
| Telephone number | +82 2 860 1463 |
| Facsimile number | +82 2 860 1468 |
| E-mail address | skcho@ctl.re.kr |
| Other Comments | -- |

II. GENERAL REQUIREMENTS OF THE EUT

1. Labelling Requirement (Section 15.19)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

1.1 Location of Label : User' guide manual

1.2 How Applied : Printed

2. Information to User (Section 15.21)

The following or similar statements were provided in the manual for user instruction.

Please refer page 3 of the attached manual for details.

CAUTION : Any changes or modifications in construction of this device which are not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

3. Special Accessories (Section 15.27)

3.1 Were the special Accessories provided?

[☐] yes, [☒] no

3.2 If yes, details for the special accessories are as follows :

3.3 If yes, were the appropriate instructions provided on the first page of the text concerned with the device?

[☐] yes, [☐] no

3.4 Are these accessories provided of the type which can be readily obtained from multiple retail outlets?

[☐] yes, [☐] no

And therefore does the manual specify what additional components or accessories are required to used in order to comply with the Rules?

[☐] yes, [☐] no

4. Antenna Requirement

The Antenna is integral to the device.

III. RADIATED EMISSION MEASUREMENT (Section 15.209 & 15.240)

1. Test Procedure

1.1 Preliminary Testing for Reference

Preliminary testing was performed in a KTL absorber-lined room to determine the emission characteristics of the EUT. The EUT was placed on the wooden table which has dimensions of 0.8 meters in height, 1 meter in length and 1.5 meters in width. Receiving antenna (Biconi-Log antenna : 30 to 1000 MHz or Horn Antenna : 1 to 18 GHz) was placed at the distance of 1 meter from the EUT.

An attempt was made to maximize the emission level with the various configurations of the EUT while rotating the table and varying antenna height.

Emissions level from the EUT with various configurations were examined on a Spectrum Analyzer connected with an RF amplifier and graphed by a plotter.

1.2 Final Radiated Emission Test at an Absorber-Lined Room

The final measurement of radiated field strength was carried out in a KTL Absorber-Lined Room that was listed up at FCC according to the "Radiated Emissions Testing" procedure specified by ANSI C63.4.

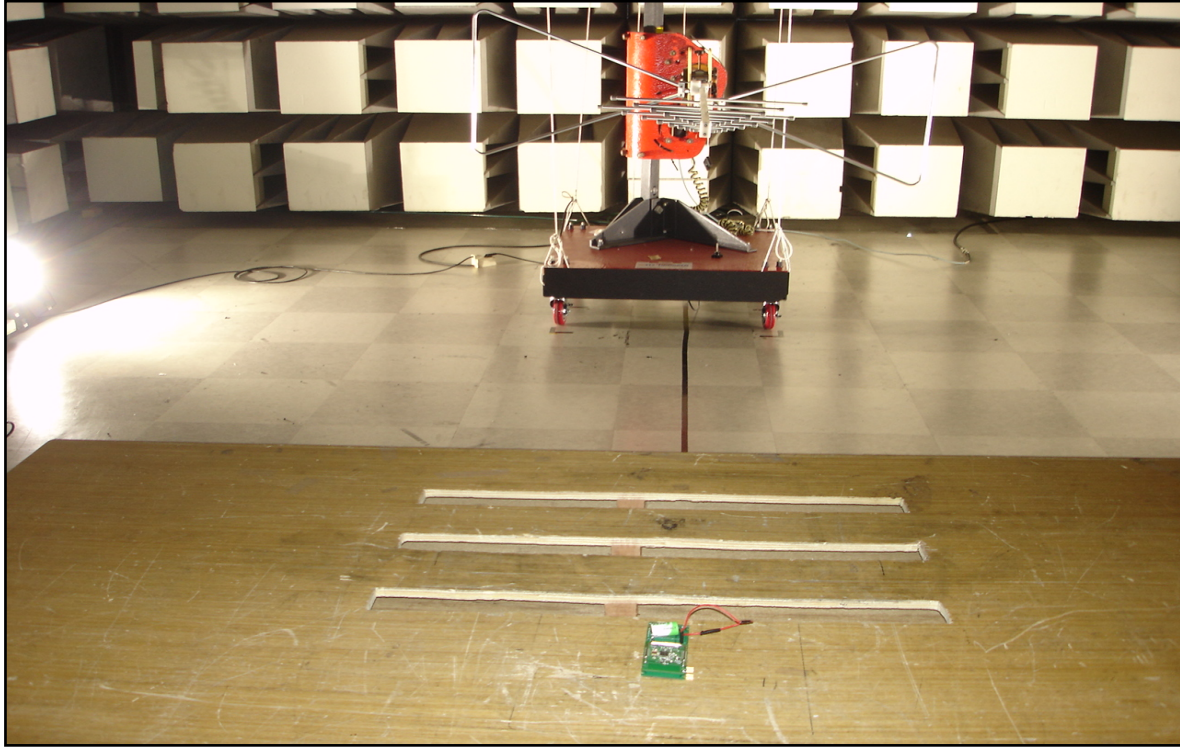
Based on the test results in preliminary test, measurement was made in same test set up and configuration which produced maximum emission level. Receiving antenna was installed at 3-meter distance from the EUT, and was connected to an EMI receiver.

Turntable was rotated through 360 degrees and receiving antenna height was varied from 1 to 4 meters above the ground plane to read maximum emission level.

If necessary, the radiated emission measurements could be performed at a closer distance than specified distance to ensure higher accuracy and their results were extrapolated to the specified distance using an inverse linear distance extrapolation factor (20 dB/decade) as per Section 15.31(f).

The maximum emission level from the EUT occurred in such configuration as shown in the following photograph.

2. Photograph for the test configuration



3. Sample Calculation

The emission level measured in decibels above one microvolt ($\text{dB } \mu\text{V}$) was converted into microvolt per meter ($\mu\text{V/m}$) as shown in following sample calculation.

The field strengths were calculated as follows ;

- $E_{\text{peak}} (\text{dB}) = E_{\text{reading}} (\text{dB}) + \alpha_p + \text{Ant. Factor \& Cable Loss} (\text{dB})$
- To get the average voltage values in the one complete pulse train blanking intervals,

$$E_{\text{averg.}} (\mu\text{V}) = \frac{E_{\text{peak}} (\mu\text{V}) \times \begin{array}{l} \text{Total pulse time of transmitter} \\ \text{in the one complete pulse train (sec)} \end{array}}{T_t (\text{sec})}$$

where,

$$\begin{aligned}
 \text{Pulse desensitization } (\alpha_p) &= 20\log(\tau_{\text{eff}} \times B \times K), \text{ HP AN150-2 (page 14)} \\
 &= \underline{0} \quad (\text{See 1.4})
 \end{aligned}$$

$$\begin{aligned}
 \text{Total pulse time of transmitter} \\
 \text{in the one complete pulse} \\
 \text{train (maximum value)} &= \underline{6 \text{ msec}} \quad (\text{See the graph of page 12})
 \end{aligned}$$

$$\begin{aligned}
 \text{One complete pulse train} \\
 \text{time including blanking} \\
 \text{interval } (T_t) &= \underline{100 \text{ msec}} \quad (\text{See the graph of page 12})
 \end{aligned}$$

For example :

the average values at 433.92 MHz

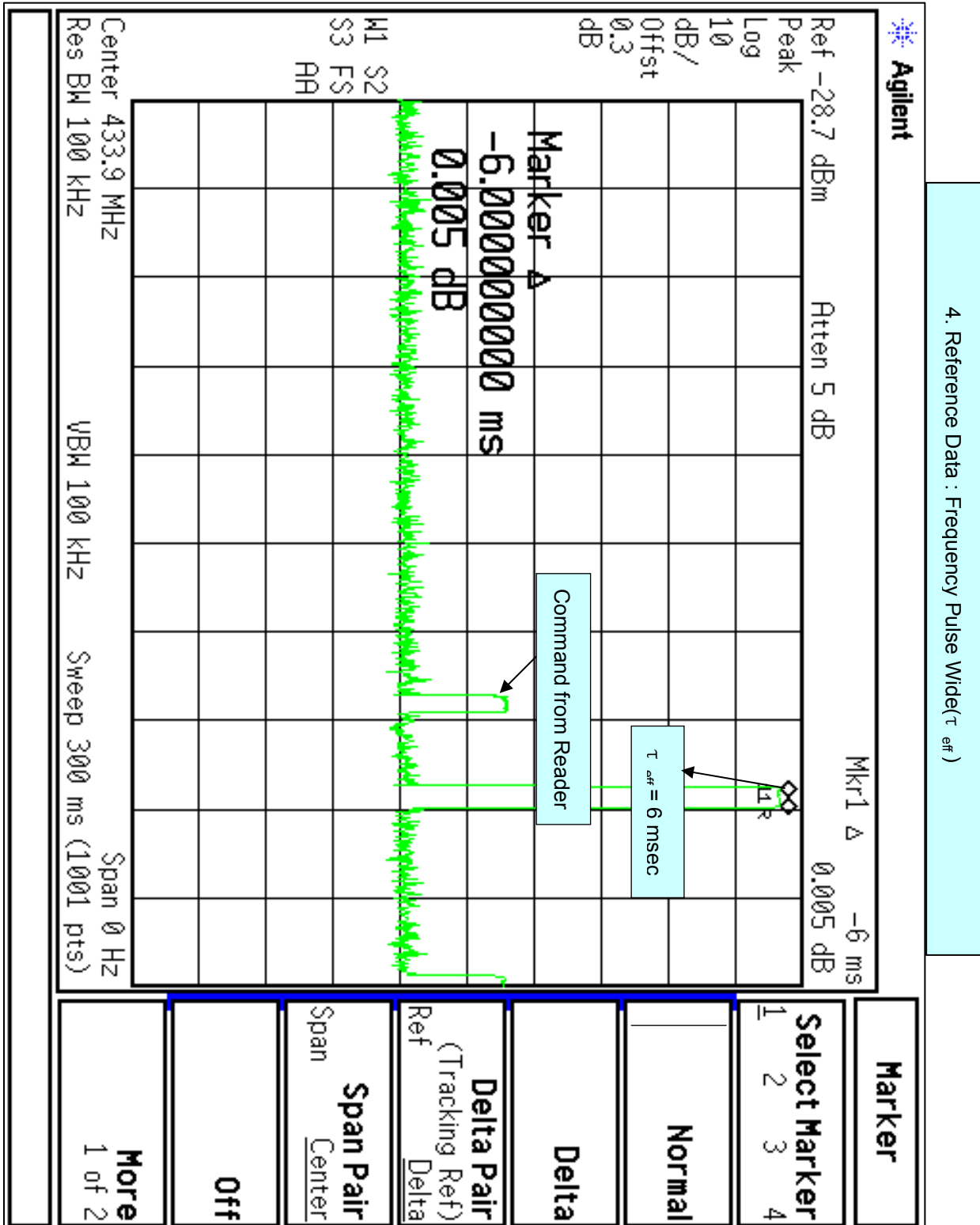
| | | | |
|--|---|-------------|------------|
| Spectrum Analyzer measured values | : | <u>67.9</u> | dB μ V |
| - Pre-amplifier | : | <u>0.0</u> | dB |
| + Pulse Desensitization (α_p) | : | <u>0.0</u> | dB |
| + Ant.Factor & Cable Loss | : | <u>18.7</u> | dB/m |

$$\begin{aligned}
 \text{Voltage Peak Levels} &: \underline{86.6} \text{ dB}\mu\text{V/m} \\
 &(\quad = \underline{21256.9} \mu\text{V/m})
 \end{aligned}$$

Voltage Average Levels

$$\begin{aligned}
 &= \frac{E_{\text{peak}} \times \text{Total pulse time of transmitter} \\
 &\quad \text{in the one complete pulse train}}{T_t} \\
 &= \frac{21256.9 \mu\text{V/m} \times 6 \text{ msec}}{100 \text{ msec}} = \underline{1275.4} \mu\text{V/m} = \underline{62.2} \text{ dB}\mu\text{V/m}
 \end{aligned}$$

4. Duty cycle plot



5. Measurement Data

- Resolution Bandwidth : [■] Peak (3 dB Bandwidth : 100 kHz for below 1 GHz, 1 MHz for above 1 GHz)
[■] Average (3 dB Bandwidth : 100 kHz for below 1 GHz, 1 MHz for above 1 GHz)
- Measurement Distance : 3 Meter
- Measurement Frequency: 30 MHz ~ 4400 MHz
- duty cycle is 6%. Average 24.4 dB correction was used to determine the average level from the peak reading.

| Frequency (MHz) | * D.M. | * A.P. | Measured Value (dB μ V) | * A.F. + C.L. (dB/m) | * A.G. (dB) | * D.C.F. (dB) | Emission Level | | Limit (dB μ V/m) | ** Margin (dB) |
|--------------------|-----------|-----------|-----------------------------------|-------------------------------|-------------------|---------------------|-------------------|--------------|-------------------------|----------------------|
| | | | | | | | (dB μ V/m) | (μ V/m) | | |
| 433.92 | P | V | 67.9 | 18.7 | 0.0 | 0.0 | 86.6 | 21256.9 | 94.8 | -8.3 |
| 433.92 | A | V | 43.5 | 18.7 | 0.0 | 0.0 | 62.2 | 1288.2 | 80.8 | -18.6 |
| 867.84 | P | H | 49.9 | 26.5 | -31.5 | 0.0 | 44.9 | 175.8 | 46.0 | -1.1 |
| 1301.76 | P | H | 52.7 | 29.8 | -29.0 | 0.0 | 53.5 | 470.4 | 74.0 | -20.6 |
| 1301.76 | A | H | 28.3 | 29.8 | -29.0 | 0.0 | 29.1 | 28.3 | 54.0 | -25.0 |
| 1735.68 | P | H | 52.1 | 32.2 | -28.5 | 0.0 | 55.8 | 617.3 | 74.0 | -18.2 |
| 1735.68 | A | H | 27.7 | 32.2 | -28.5 | 0.0 | 31.4 | 37.2 | 54.0 | -22.6 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

Note

The observed EMI receiver(ESVS30) noise floor level was 2.0 dB μ V. And all other emissions not reported on data were more than 25 dB below the permitted level.

- * D.M. : Detect Mode (P : Peak, Q : Quasi-Peak, A : Average)
- A.P. : Antenna Polarization (H : Horizontal, V : Vertical)
- A.F. : Antenna Factor
- C.L. : Cable Loss
- A.G. : Amplifier Gain
- D.C.F. : Distance Correction Factor
- < : Less than

** Margin (dB) = Emission Level (dB) - Limit (dB)

Note ;

- (1) Fundamental emissions from the intentional radiators were not located within any of frequency bands described in section 15.205(a) listed below ;

| MHz | MHz | MHz | GHz |
|-------------------|---------------------|---------------|-------------|
| 0.090-0.110 | 16.42-16.423 | 399.9-410 | 4.5-5.25 |
| 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 |
| 4.17725-4.1775 | 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 | |
| 13.36-13.41 | | | |

The field strength of emissions appearing within above frequency bands did not exceed the limits shown in section 15.209. At frequency equal to or less than 1000MHz, compliance with the limits section 15.209 was demonstrated using measurement employing a CISPR quasi-peak detector. Above 1000MHz, demonstrated based on the average value of the measured emissions.

- (2) If the intentional radiator was operated under the radiated emission limits of the general requirements of section 15.209, it's fundamental emissions were not located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-860MHz.
- (3) The level of any unwanted emissions from an intentional radiator did not exceed the level of the fundamental emission.
- (4) Radiated and spurious emissions were checked from 30MHz to 3GHz. And all other emissions not reported on data were more than 20 dB below the permitted level.

IV. DURATION OF TRANSMISSIONS (Section 15.240(b))

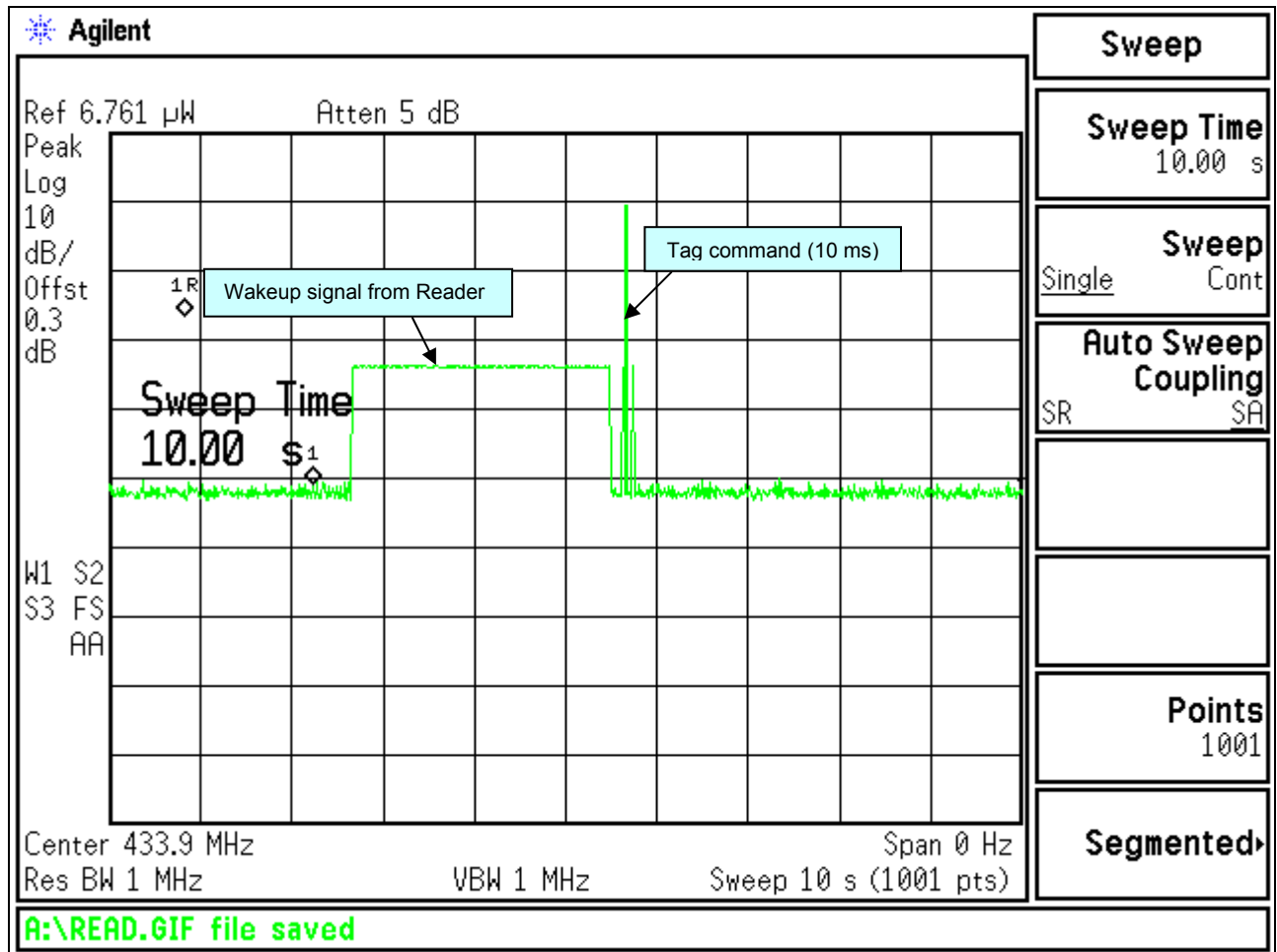
1. Description

The Tag is triggered by a reader to send transmissions under 15.240(b).

The maximum transmit time is 6 ms.

The client declare that a silent period is longer than 10s.

2. Operation plot



V. TEST EQUIPMENTS

| No. | Equipment | Manufacturer | Model | S/N | Effective Cal.Duration |
|-----|--|--------------|----------|------------|-------------------------|
| 1 | EMI Receiver (20 MHz ~ 1 GHz) | R&S | ESVS30 | 830516002 | 03/15/2006 ~ 03/15/2007 |
| 2 | EMI Receiver (9 kHz ~ 3 GHz) | R&S | ESCI | 100076 | 03/28/2006 ~ 03/28/2007 |
| 3 | Spectrum Analyzer (100 Hz ~ 26.5 GHz) | Agilent | E4407B | US41443316 | 12/01/2006 ~ 12/01/2007 |
| 4 | Spectrum Analyzer (3 Hz ~ 50 GHz) | Agilent | E4448A | MY43360322 | 02/26/2006 ~ 02/26/2007 |
| 5 | Test Receiver (9 kHz ~ 30 MHz) | R&S | ESH3 | 860905001 | 06/18/2006 ~ 06/18/2007 |
| 6 | Pre-Amplifier (100 kHz ~ 3 GHz) | H.P. | 8347A | 2834A00543 | 05/19/2006 ~ 05/19/2007 |
| 7 | Pre-Amplifier (1 GHz ~ 26.5 GHz) | H.P. | 8449B | 3008A00302 | 06/14/2006 ~ 06/14/2007 |
| 8 | LISN(50 Ω , 50 μ H) (10 kHz ~ 100 MHz) | R&S | ESH3-Z5 | 826789009 | 07/05/2006 ~ 07/05/2007 |
| 9 | Biconi-Log Ant. (30 MHz ~ 1000 MHz) | Schwarzbeck | VULB9168 | 9168-168 | 08/16/2006 ~ 08/16/2007 |
| 10 | Horn Ant. (1 GHz ~ 18 GHz) | EMCO | 3115 | -- | 05/09/2006 ~ 05/09/2007 |
| 11 | Active Loop Ant. (9 kHz ~ 30 MHz) | EMCO | 6502 | 2532 | 06/08/2006 ~ 06/08/2007 |
| 12 | Shielded Room (5.0 m x 4.5 m) | SIN-MYUNG | -- | -- | -- |
| 13 | Signal Generator (250 kHz ~ 20 GHz) | Agilent | E8257D | MY44320379 | 01/02/2007 ~ 01/02/2008 |
| 14 | DC Power Supply | Agilent | E4356A | MY41000296 | 09/28/2006 ~ 09/28/2007 |
| 15 | Power Splitter | H.P. | 11667A | 21063 | 10/09/2006 ~ 10/09/2007 |
| 16 | Power Meter | Agilent | E4417A | GB4129075 | 09/17/2006 ~ 09/17/2007 |
| 17 | Attenuator | Weinschel | 56-20 | N8257 | 01/13/2006 ~ 01/13/2007 |
| 18 | Oscillator | Kenwood | AG-203D | 10040568 | 10/23/2006 ~ 10/23/2007 |