



Underwriters
Laboratories UL Japan, Inc.

Test report No. : 27KE0198-HO-C
Page : 1 of 24
Issued date : September 10, 2007
FCC ID : S4JS1613-01A

EMI TEST REPORT

Test Report No. : 27KE0198-HO-C

Applicant : NEC INFRONTIA CORPORATION

Type of Equipment : Mobile Terminal EX

Model No. : S1613-01A

FCC ID : S4JS1613-01A

Test standard : FCC Part 15 Subpart E:2007
Section 15.407(DFS test only)

Test Result : Complied

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with above regulation.
4. The test results in this report are traceable to the national or international standards.

Date of test : July 24 and September 6, 2007

Tested by : T. Hatakeda
Takahiro Hatakeda
EMC Services

Approved by : H. Shimoji
Hironobu Shimoji
Site manager of
EMC Services

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MF060b(18.06.07)

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SECTION 1: Client information

Company Name : NEC INFRONTIA CORPORATION
 Address : 2-6-1 Kitamikata, Takatsu-Ku, Kawasaki 213-8511, Japan
 Telephone Number : +81- 44-820-3881
 Facsimile Number : +81- 44-820-4534
 Contact Person : Yoshihiro Hagiwara

SECTION 2: Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment : Mobile Terminal EX
 Model No. : S1613-01A
 Serial No. : #10
 Rating : DC12V (AC Adapter input: AC100V-240V)
 Country of Manufacture : Japan
 Receipt Date of Sample : June 22, 2007
 Condition of EUT : Production prototype
 (Not for Sale: This sample is equivalent to mass-produced items.)
 Modification of EUT : No modification by the test lab.

2.2 Product Description

Model No: S1613-01A (referred to as the EUT in this report) is the Mobile Terminal EX.

Clock frequency : 1GHz (CPU), 40MHz (Wireless LAN port)

| Equipment Type | Transceiver | | | | |
|------------------------|------------------------|-------------------|-------------------|--|--|
| Frequency of Operation | 11b/11g | 2412MHz - 2462MHz | | | |
| | 11a | Low | 5180MHz - 5240MHz | | |
| | | Mid | 5260MHz - 5320MHz | | |
| | | Add | 5500MHz - 5700MHz | | |
| | | Upper | 5745MHz - 5805MHz | | |
| | 5825MHz | | | | |
| Type of Modulation | 11b | DSSS | | | |
| | | DBPSK | : 1Mbps | | |
| | 11a/11g | DQPSK | : 2Mbps | | |
| | | CCK | : 5.5Mbps, 11Mbps | | |
| | | OFDM | | | |
| | | BPSK | : 6Mbps, 9Mbps | | |
| | | QPSK | : 12Mbps, 18Mbps | | |
| | 11a | 16QAM | : 24Mbps, 36Mbps | | |
| | | 64QAM | : 48Mbps, 54Mbps | | |
| Channel spacing | 11b/11g | 5MHz | | | |
| | 11a | 20MHz | | | |
| Power Supply (inner) | DC3.3V, 1.8V | | | | |
| Antenna Type | Internal antenna | | | | |
| Antenna Connector Type | U.FL (ANT-A and ANT-B) | | | | |
| Antenna Gain | 0dBi | | | | |

Remarks : This Wireless Module consists of 1 chip each of 2.4GHz band and 5GHz band.

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FCC 15.31 (e)

This EUT provides stable voltage(DC3.3, 1.8V) constantly to RF Module regardless of input voltage. Therefore, this EUT complies with the requirement.

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SECTION 3: Scope of Report

The EUT has the channels from 5180 to 5825MHz.

This report only covers DFS requirement subject to 5250-5350MHz and 5470-5725MHz bands, as specified by the following referenced procedures.

SECTION 4: Test specification, procedures & results

4.1 Test Specification

| | | |
|--------------------|---|--|
| Test Specification | : | FCC Part15 Subpart E:2007 |
| Title | : | FCC 47CFR Part15 Radio Frequency Device Subpart E Unlicensed National Information Infrastructure Devices Section 15.407 General technical requirements |
| Test Specification | : | FCC 06-96 APPENDIX |
| Title | : | COMPLIANCE MEASUREMENT PROCEDURES FOR UNLICENSED-NATIONAL INFORMATION INFRASTRUCTURE DEVICES OPERATING IN THE 5250-5350 MHz AND 5470-5725MHz BANDS INCORPORATING DYNAMIC FREQUENCY SELECTION |

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4.2 Procedures and results

Table 1: Applicability of DFS Requirements

| Requirement | Operating Mode | Test Procedures & Limits | Deviation | Results |
|--|----------------|--|-----------|----------|
| | | | | |
| U-NII Detection Bandwidth | Not required | FCC 06-96 Appendix 7.8.1 | N/A | N/A |
| Initial Channel Availability Check Time | Not required | FCC15.407 (h)(2)(ii) ----- FCC 06-96 Appendix 7.8.2.1 | N/A | N/A |
| Radar Burst at the Beginning of the Channel Availability Check Time | Not required | FCC15.407 (h)(2)(ii) ----- FCC 06-96 Appendix 7.8.2.2 | N/A | N/A |
| Radar Burst at the End of the Channel Availability Check Time | Not required | FCC15.407 (h)(2)(ii) ----- FCC 06-96 Appendix 7.8.2.3 | N/A | N/A |
| In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time | Yes | FCC15.407 (h)(2)(iii) ----- FCC 06-96 Appendix 7.8.3 | N/A | Complied |
| In-Service Monitoring for Non-Occupancy period | Yes * | FCC15.407 (h)(2)(iv) ----- FCC 06-96 Appendix 7.8.3 | N/A | Complied |
| Statistical Performance Check | Not required | FCC15.407 (h)(2) ----- FCC 06-96 Appendix 7.8.4 | N/A | N/A |

* Although this test was not required in FCC 06-96, it was performed as additional test.

Table 2: DFS Detection Thresholds for Master Devices and Client Devices With Radar

| Maximum Transmit Power | Value (See Notes 1 and 2) |
|--|---------------------------|
| ≥ 200 milliwatt | -64 dBm |
| < 200 milliwatt | -62 dBm |
| Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna. | |
| Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response. | |

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Table 3 DFS Response Requirement Values

| Parameter | Value |
|--|--|
| Non-occupancy period | Minimum 30 minutes |
| Channel Availability Check Time | 60 seconds |
| Channel Move Time | 10 seconds See Note 1 |
| Channel Closing Transmission Time | 200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2 |
| U-NII Detection Bandwidth | Minimum 80% of the U-NII 99% transmission power bandwidth See Note 3 |
| <p>Note 1: The instant that the Channel Move Time and the Channel Closing Transmission Time begins is as follows:</p> <ul style="list-style-type: none"> • For the Short Pulse Radar Test Signals this instant is the end of the <i>Burst</i>. • For the Frequency Hopping radar Test Signal, this instant is the end of the last radar <i>Burst</i> generated • For the Long Pulse Radar Test Signal this instant is the end of the 12 second period defining the <i>Radar Waveform</i>. <p>Note 2: The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time plus any additional intermittent control signals required to facilitate a Channel move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signal will not count quiet periods in between transmissions.</p> <p>Note 3: During the U-NII Detection Bandwidth detection test, radar type 1 is used and for each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.</p> | |

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Table 4 Short Pulse Radar Test Waveform

| Radar Type | Pulse Width (μsec) | PRI (μsec) | Number of Pulses | Minimum Percentage of Successful Detection | Minimum Number of Trials |
|-----------------------------|--------------------|------------|------------------|--|--------------------------|
| 1 | 1 | 1428 | 18 | 60% | 30 |
| 2 | 1-5 | 150-230 | 23-29 | 60% | 30 |
| 3 | 6-10 | 200-500 | 16-18 | 60% | 30 |
| 4 | 11-20 | 200-500 | 12-16 | 60% | 30 |
| Aggregate (Rader Types 1-4) | | | | 80% | 120 |

Table 5 Long Pulse Radar Test Waveform

| Radar Type | Pulse Width (μsec) | Chip Width (MHz) | PRI (μsec) | Number of Pulses per Burst | Number of Burst | Minimum Percentage of Successful Detection | Minimum Number of Trials |
|------------|--------------------|------------------|------------|----------------------------|-----------------|--|--------------------------|
| 5 | 50-100 | 5-20 | 1000-2000 | 1-3 | 8-20 | 80% | 30 |

Table 6 Frequency Hopping Radar Test Waveform

| Radar Type | Pulse Width (μsec) | PRI (μsec) | Pulse per Hop (kHz) | Hopping Rate (kHz) | Hopping Sequence Length (msec) | Minimum Percentage of Successful Detection | Minimum Number of Trials |
|------------|--------------------|------------|---------------------|--------------------|--------------------------------|--|--------------------------|
| 6 | 1 | 333 | 9 | 0.333 | 300 | 70% | 30 |

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4.3 Test Location

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| | FCC Registration Number | IC Registration Number | Width x Depth x Height (m) | Size of reference ground plane (m) / horizontal conducting plane | Other rooms |
|----------------------------|-------------------------|------------------------|----------------------------|--|------------------------|
| No.1 semi-anechoic chamber | 313583 | IC4247 | 19.2 x 11.2 x 7.7m | 7.0 x 6.0m | No.1 Power source room |
| No.2 semi-anechoic chamber | 655103 | IC4247-2 | 7.5 x 5.8 x 5.2m | 4.0 x 4.0m | - |
| No.3 semi-anechoic chamber | 148738 | IC4247-3 | 12.0 x 8.5 x 5.9m | 6.8 x 5.75m | No.3 Preparation room |
| No.3 shielded room | - | - | 4.0 x 6.0 x 2.7m | N/A | - |
| No.4 semi-anechoic chamber | 134570 | IC4247-4 | 12.0 x 8.5 x 5.9m | 6.8 x 5.75m | No.4 Preparation room |
| No.4 shielded room | - | - | 4.0 x 6.0 x 2.7m | N/A | - |
| No.5 semi-anechoic chamber | - | - | 6.0 x 6.0 x 3.9m | 6.0 x 6.0m | - |
| No.6 shielded room | - | - | 4.0 x 4.5 x 2.7m | 4.75 x 5.4 m | - |
| No.6 measurement room | - | - | 4.75 x 5.4 x 3.0m | 4.75 x 4.15 m | - |
| No.7 shielded room | - | - | 4.7 x 7.5 x 2.7m | 4.7 x 7.5m | - |
| No.8 measurement room | - | - | 3.1 x 5.0 x 2.7m | N/A | - |

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

4.4 Test set up and Test instruments of DFS

Refer to APPENDIX 1 to 3.

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SECTION 5: Operation of E.U.T. during testing

5.1 Operating Modes

The EUT, which is a Client Device without Radar detection capability, operates over the 5250-5350MHz and 5470-5725MHz band.

Power level(EIRP) of the EUT[dBm]

| Antenna Type | Antenna | 5250-5350MHz band *1) | | 5470-5725MHz band *1) | |
|------------------|-----------|-----------------------|-------------------|-----------------------|-------------------|
| | Gain[dBi] | Output Power (Min) | Output Power(Max) | Output Power (Min) | Output Power(Max) |
| Internal antenna | 0.00 | 6.99 | 8.49 | 7.48 | 7.97 |

*1) For other parts than DFS refer to 27KE0198-HO-B, FCC Part 15 Subpart E (FCC 15.407) report issued by UL Japan, Inc.

The lowest antenna assembly gain of all available antenna assemblies is 0dBi.

The EUT uses one transmitter connected to two 50-ohm coaxial antenna ports via a diversity switch. Both antenna ports are connected to the test system via a power divider to perform conducted tests.

WLAN traffic is generated by streaming the MPEG Test file “6 ½ Magic Hours” from the Master to the Client in full motion video mode using the media player with the V2.61 Codec package.

The EUT utilizes the 802.11a architecture.

The FCC ID for the Master Device used with EUT for DFS testing is LDK102056.

The rated output power of the Master unit is >200mW(23dBm). Therefore the required interference threshold level is -64 dBm. After correction for antenna gain and procedural adjustments, the required conducted threshold at the antenna port is $-64 + 1 + 3.5 = -59.5$ dBm (threshold level + additional 1dB + antenna gain):

The calibrated conducted DFS detection Threshold level is set to -64dBm. The tested level is lower than the required level hence it provides margin to the limit.

About the specification of wireless LAN of Mobile Terminal EX, Wireless LAN module installed in this device preserves a set code as a key that decides the operational channel and the DFS operation in EEPROM. Because the driver sets the operational channel and the DFS operation referring to this set code, the setting change by the user cannot be done. The device doesn't have utility etc. to which the setting is changed.

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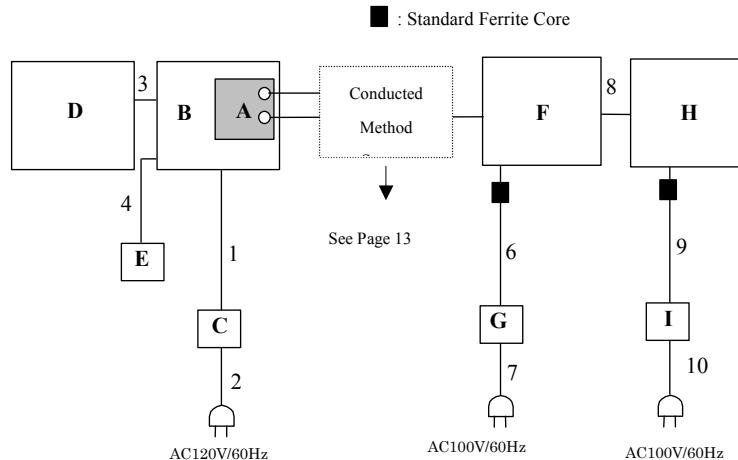
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5.2 Configuration and peripherals



Description of EUT and Support equipment

| No | Item | Model number | Serial number | Manufacturer | Remarks |
|----|------------------------------|-------------------|-------------------------|------------------------|---------------------------|
| A | Mobile Terminal EX | S1613-01A | #10 | NEC INFRONTIA | EUT |
| B | Single Docking Station | 3024A APX | 0001090225A0 | NEC INFRONTIA | - |
| C | AC Adapter | S1596-04/ADPI004 | 0604B0002947G | NEC | - |
| D | USB Keyboard | TK-U12FY | 040107169 | ELECOM | - |
| E | Mouse | M-UB48 | LZE02650788 | Logitech | - |
| F | Access Point (Client device) | AIR-AP1242AG-A-K9 | FTX1045B9L0 | Cisco Systems | Master FCC ID : LDK102056 |
| G | AC Adapter | ADP-18PB | PZT0639562214 | DLTA ELECTRONICS, INC. | - |
| H | Note PC | 2647-LJ3 | 97-ALT8N | IBM | - |
| I | AC Adapter | 02K6750 | 11S02K6750Z1Z2UP2 9909J | IBM | - |

List of cables used

| No. | Name | Length (m) | Shield | |
|-----|-----------|------------|------------|------------|
| | | | Cable | Connector |
| 1 | DC Cable | 1.2 | Unshielded | Unshielded |
| 2 | AC Cable | 1.5 | Unshielded | Unshielded |
| 3 | USB Cable | 1.5 | Shielded | Shielded |
| 4 | USB Cable | 0.8 | Shielded | Shielded |
| 5 | AC Cable | 1.0 | Unshielded | Unshielded |
| 6 | DC Cable | 1.8 | Unshielded | Unshielded |
| 7 | AC Cable | 2.0 | Unshielded | Unshielded |
| 8 | LAN Cable | 1.0 | Unshielded | Unshielded |
| 9 | DC Cable | 1.8 | Unshielded | Unshielded |
| 10 | AC Cable | 1.8 | Unshielded | Unshielded |

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5.3 Test and Measurement System

SYSTEM OVERVIEW

The measurement system is based on a conducted test method.

The software selects waveform parameters from within the bounds of the signal type on a random basis using uniform distribution. The short pulse types 2, 3, and 4, the long pulse type 5, and the frequency hopping type 6 parameters are randomized at run-time.

The signal monitoring equipment consists of a spectrum analyzer with the capacity to display 8192 bins on the horizontal axis. A time-domain resolution of 2 msec/bin is achievable with a 16 second sweep time, meeting the 10 seconds short pulse reporting criteria. The aggregate ON time is calculated by multiplying the number of bins above a threshold during a particular observation period by the dwell time per bin, with the analyzer set to peak detection. A time-domain resolution of 3 msec/bin is achievable with a 24 second sweep time, meeting the 22 second long pulse reporting criteria and allowing a minimum of 10 seconds after the end of the long pulse waveform.

FREQUENCY HOPPING RADAR WAVEFORM GENERATING SUBSYSTEM

The first 100 frequencies are selected out of the hopping sequence of the randomized 475 hop frequencies. Only a *Burst* that has the frequency falling within the receiver bandwidth of the tested U-NII device is selected among those frequencies. (Frequency-domain simulation). The radar waveform generated at the start time of the selected *Burst* (Time-domain simulation) is download to the Signal Generator. If all of the randomly selected 100 frequencies do not fall within the receiver bandwidth of the U-NII device, the radar waveform is not used for the test.

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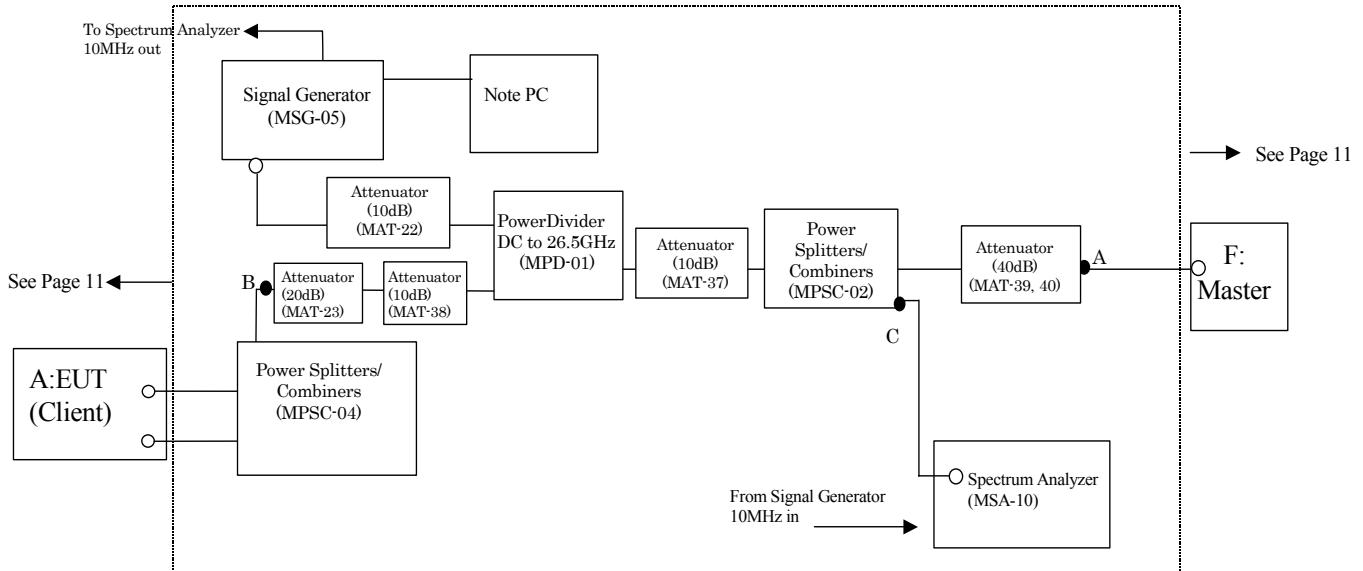
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CONDUCTED METHODS SYSTEM BLOCK DIAGRAM



MEASUREMENT SYSTEM FREQUENCY REFERENCE

Lock the signal generator and the spectrum analyzer to the same reference sources as follows: Connect the 10MHz OUT on the signal generator to the 10MHz IN on the spectrum analyzer and set the spectrum analyzer 10MHz In to On.

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SYSTEM CALIBRATION

Step 1: Set the system as shown in Figure 3 of FCC 06-96 7.2.1.

Step 2: Adjust each attenuator to fulfill the following three conditions:

- WLAN can be communicated, and
- Radar detection threshold level is bigger than Client Device traffic level on the spectrum analyzer, and
- Master Device traffic level is not displayed on the spectrum analyzer.

Step 3: Terminate 50 ohm at B and C points, and connect the spectrum analyzer to the point A. (See the figure on page 13) At the point A, adjust the signal generator and spectrum analyzer to the center frequency of the channel to be measured. Download the applicable radar waveforms to the signal generator. Select the radar waveform, trigger a burst manually and measure the amplitude on the spectrum analyzer. Readjust the amplitude of the signal generator as required so that the peak level of the waveform is at a displayed level equal to the required or desired interference detection threshold. Separate signal generator amplitude settings are determined as required for each radar type.

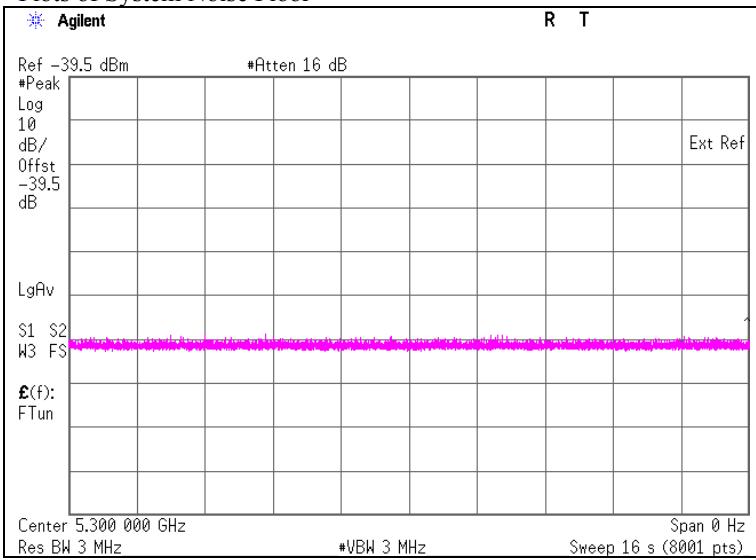
Step 4: Without changing any of the instrument settings, restore the system setting to Step 2 and adjust the Reference Level Offset of the spectrum analyzer to the level at Step 3.

By taking the above steps 1 to 4, the spectrum analyzer displays the level of the signal generator as received at the antenna ports of the Master Device.

See Clause 5.4 for Plots of Noise, Radar Waveforms, and WLAN signals.

5.4 Plots of Noise, Radar Waveforms, and WLAN signals

Plots of System Noise Floor



It was confirmed that the EUT did not transmit before having received appropriate control signals from a Master Device.

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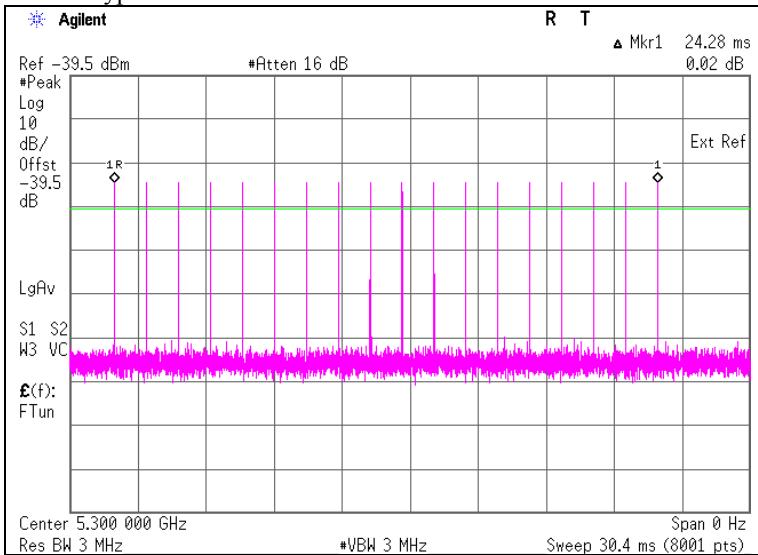
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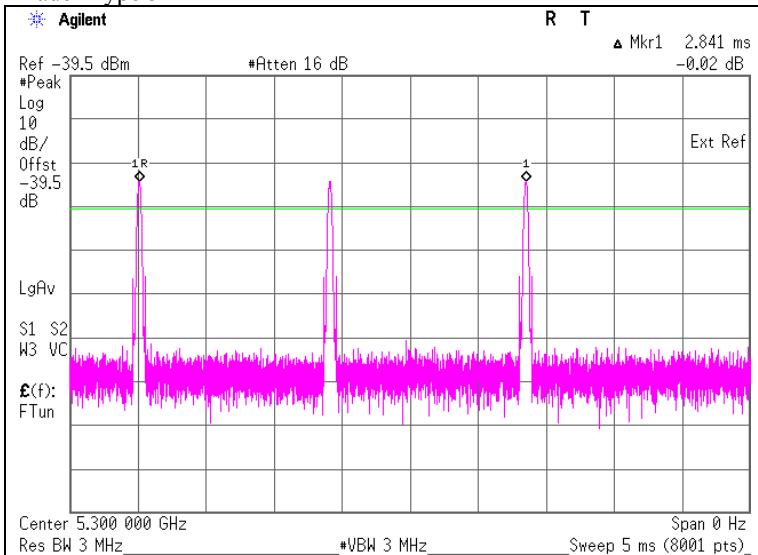
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Plots of Radar Waveforms

Rader Type 1



Rader Type 5



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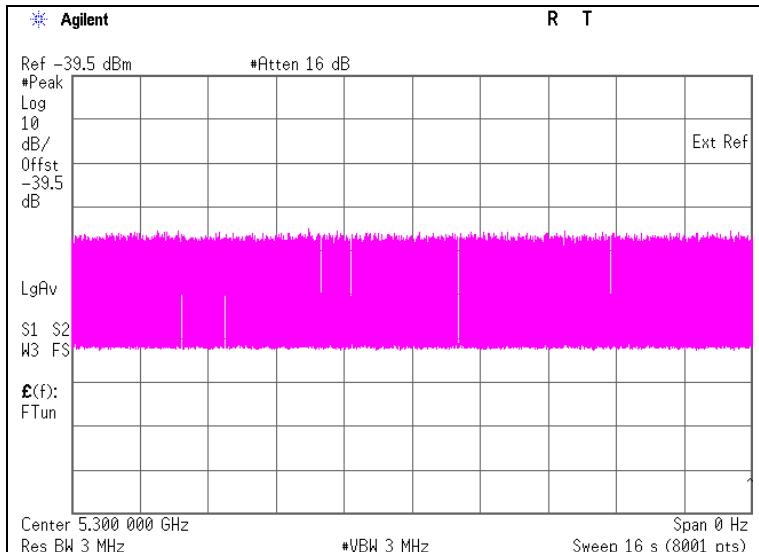
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Plots of WLAN Traffic



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SECTION 6: In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time

6.1 Operating environment

Test place : No.6 measurement room
Temperature : 26deg.C.
Humidity : 58%

6.2 Test Procedure

Stream the MPEG test file from the Master Device to the Client Device on the test Channel for the entire period of the test. the Radar Waveform generator sends a Burst of pulses for one of the Short Pulse Radar Types 1-4 at levels defined , on the Operating Channel. An additional 1 dB is added to the radar test signal to ensure it is at or above the DFS Detection Threshold, accounting for equipment variations/errors.

Observe the transmissions of the EUT at the end of the radar Burst on the Operating Channel for duration greater than 10 seconds.

6.3 Test data

| Test Item | Unit | Measurement Time | Limit | Results |
|---------------------------------------|--------|------------------|--------|---------|
| Channel Move Time *1) | [sec] | 0.098 | 10.000 | Pass |
| Channel Closing Transmission Time *2) | [msec] | 0 | 60 | Pass |

*1) Channel Move Time is calculated as follows:

$$(\text{Channel Move Time}) = (\text{End of Transmission}) - (\text{End of Burst}) = 0.824 - 0.726$$

*2). Channel Closing Transmission Time is calculated from (End of Burst + 200msec) to (End of Burst + 10sec)

$$\begin{aligned}(\text{Channel Closing Transmission Time}) &= (\text{Number of analyzer bins showing transmission}) * (\text{dwell time per bin}) \\ &= 0 * 2[\text{msec}]\end{aligned}$$

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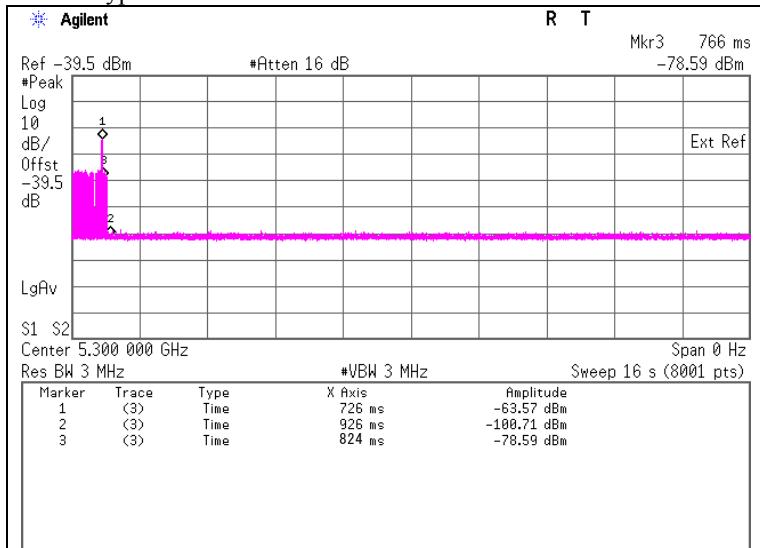
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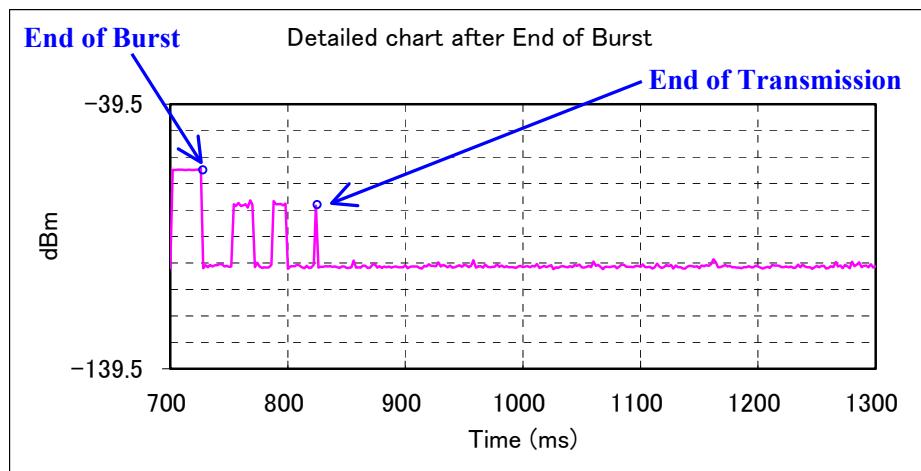
Radar Type 1



Marker 1 : End of Burst : 726 ms

Marker 2 : End of Burst + 200 msec : 926 ms

Marker 3 : End of Transmission : 824 ms



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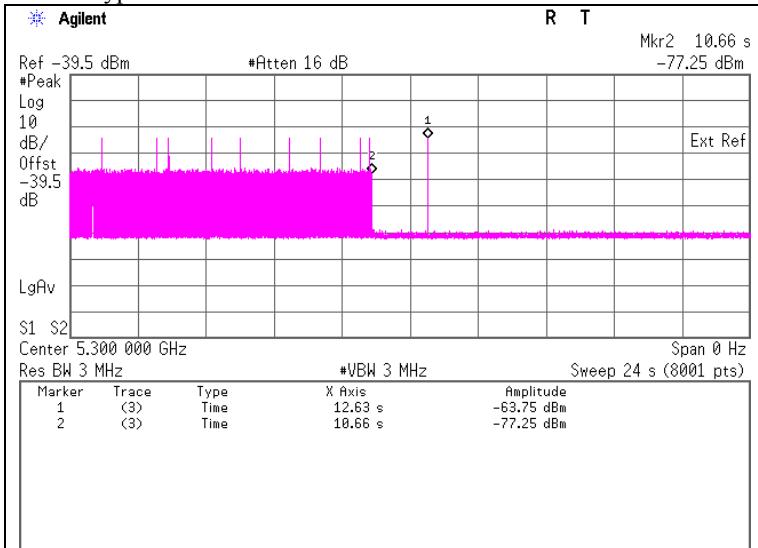
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Radar Type 5



Marker 1 : End of Burst : 12630 ms

Marker 2 : End of Transmission : 10660 ms

6.4 Test result

Test result: Pass

Date : 07 /24 / 2007

Test engineer : Takahiro Hatakeda

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SECTION 7: In-Service Monitoring for Non-Occupancy Period

7.1 Operating environment

Test place : No.6 measurement room
 Temperature : 26deg.C.
 Humidity : 59%

7.2 Test Procedure

The following two tests are performed:

1). Stream the MPEG test file from the Master Device to the Client Device on the test Channel for the entire period of the test.

The Radar Waveform generator sends a Burst of pulses for one of the Radar Types 1-6 at levels defined on the Operating Channel. An additional 1 dB is added to the radar test signal to ensure it is at or above the DFS Detection Threshold, accounting for equipment variations/errors.

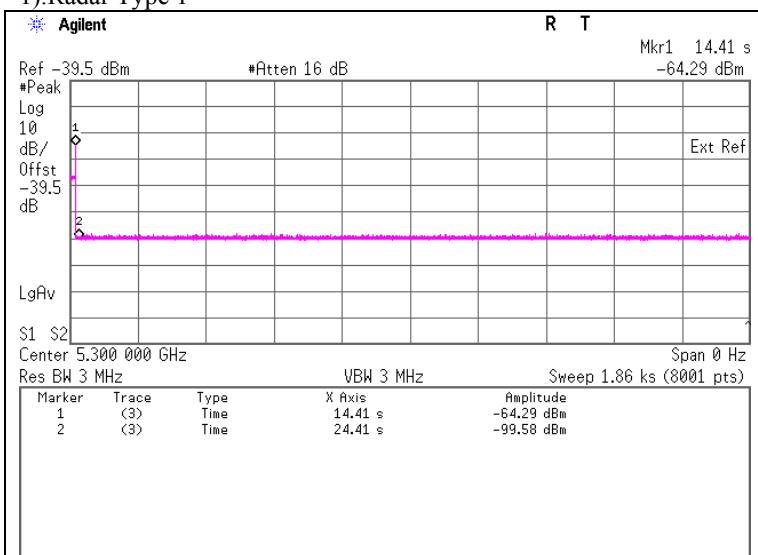
Observe the transmissions of the EUT after the Channel Move Time on the Operating Channel for duration greater than 30 minutes.

2). Stream the MPEG test file from the Master Device to the Client Device on the test Channel for the entire period of the test.

Observe the transmissions of the EUT on the Operating Channel for duration greater than 30 minutes after the Master Device is shut off.

7.3 Test data

1).Radar Type 1



Marker 1 : End of Burst : 14410 ms
Marker 2 : End of Burst +10sec : 24410 ms

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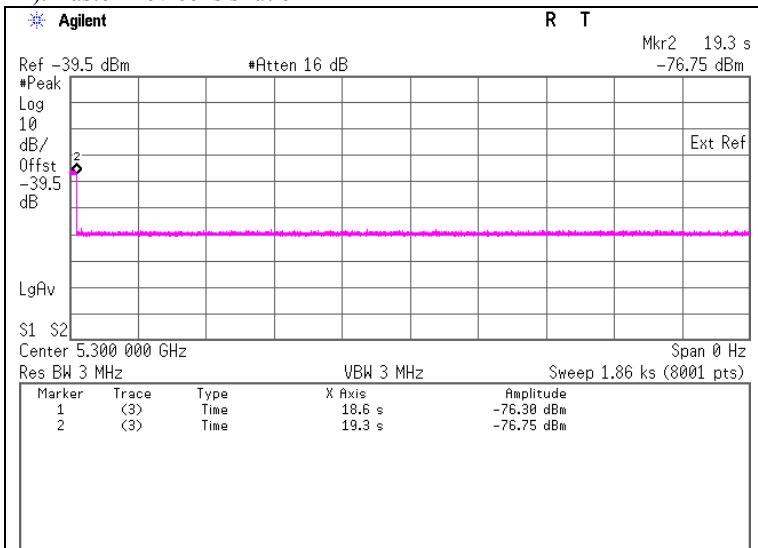
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2).Master Device is shut off



Marker 1 : Master Device is shut off : 18600 ms

Marker 2 : End of Transmission : 19300 ms

7.4 Test result

Test result: Pass

Date : 09 / 06 / 2007

Test engineer : Takahiro Hatakeda

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