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TEST REPORT

Covering the
DYNAMIC FREQUENCY SELECTION (DFS)
REQUIREMENTS
OF

FCC Part 15 Subpart E (UNII)

Research In Motion
Model(s): Meteor RBT71UW

COMPANY:	Research In Motion 305 Phillip Street Waterloo, Ontario, Canada, N2L 3W8
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Ave Sunnyvale, CA 94085
REPORT DATE:	May 5, 2008
REISSUE DATE:	June 26, 2008
FINAL TEST DATE:	April 23, 2008
TEST ENGINEER:	Wayne Fisher
AUTHORIZED SIGNATORY:	Mark Briggs Staff Engineer (EMC)

ACCREDITED

Testing Cert #2016-01

REVISION HISTORY

Rev #	Date	Comments	Modified By
1.0	May 5, 2008	Initial Release	-
2.0	June 26, 2008	Modified calibration due date for the E8267C Signal Generator, asset number 1877. Device was calibrated on 2/15/08 and the next calibration is on 2/15/2010. Modified calibration due date for the 3117 Horn Antenna, asset number 1662. Device was calibrated on 4/11/08 and the next calibration is on 4/11/2010.	Dave G

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SCOPE

The Federal Communications Commission and the European Telecommunications Standards Institute (ETSI) publish standards regarding ElectroMagnetic Compatibility and Radio spectrum Matters for radio-communications devices. Tests have been performed on the Research In Motion model Meteor RBT71UW in accordance with these standards.

Test data has been taken pursuant to the relevant DFS requirements of the following standard(s). In the cases of ETSI (EN) standards, testing was limited to those aspects covering essential requirements under article 3.2 of the R&TTE Directive:

- FCC Part 15 Subpart E Unlicensed National Information Infrastructure (U-NII) Devices

Tests were performed in accordance with these standards together with the current published versions of the basic standards referenced therein as outlined in Elliott Laboratories test procedures.

The test results recorded herein are based on a single type test of the Research In Motion model Meteor RBT71UW and therefore apply only to the tested sample. The sample was selected and prepared by by Masud Attayi of Research In Motion.

OBJECTIVE

The objective of the manufacturer is to comply with the standards identified in the previous section. In order to demonstrate compliance, the manufacturer or a contracted laboratory makes measurements and takes the necessary steps to ensure that the equipment complies with the appropriate technical standards. Compliance with some DFS features is covered through a manufacturer statement or through observation of the device.

STATEMENT OF COMPLIANCE

The tested sample of Research In Motion model Meteor RBT71UW complied with the DFS requirements of:

FCC Part 15.407(h)(2)

Maintenance of compliance is the responsibility of the manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the device with respect to the standards detailed in this test report.

DEVIATIONS FROM THE STANDARD

The MPEG file was not streamed to the EUT as required by FCC test procedures. Refer to EUT operation for a description of how the tests were performed.

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Research In Motion model Meteor RBT71UW is a Dual-Mode Cellular Wi-Fi Smartphone (BlackBerry FCC ID L6ARBT70UW).

The sample was received on April 15, 2008 and tested on April 23, 2008. The EUT consisted of the following component(s):

Manufacturer	Model	Description	Serial Number
Research in Motion	Meteor RBT71UW	Smartphone	57

The manufacturer declared values for the EUT operational characteristics that affect DFS are as follows:

Operating Modes (5250 – 5350 MHz, 5470 – 5725 MHz)

☐ Master Device

☒ Client Device (no In Service Monitoring, no Ad-Hoc mode)

☐ Client Device with In-Service Monitoring

Antenna Gains / EIRP (5250 – 5350 MHz, 5470 – 5725 MHz)

	5240 MHz	5540 MHz	5700MHz
Average Gain (dBi)	-0.76	-2.62	-2.21
Peak Gain (dBi)	4.05	2.68	4.06
Minimum Gain (dBi)	-3.7	-6.92	-7.1

Note: Antenna characteristics reflect the manufacturers built in antenna.

Channel Protocol

☒ IP Based

☐ Frame Based

☐ OTHER _____

ENCLOSURE

The EUT enclosure measures approximately 11.5 by 6.7 by 1.0 centimeters. It is primarily constructed of plastic with metal parts.

MODIFICATIONS

The EUT did not require modifications during testing in order to comply with the requirements of the standard(s) referenced in this test report.

SUPPORT EQUIPMENT

The following equipment was used as local support equipment for testing:

Manufacturer	Model	Description	Serial Number	FCC ID
Cisco Systems	*Aironet 1250AG Series*	*Access Point*	*FTX1209906V*	*LDK102061*

The italicized device was the master device.

EUT INTERFACE PORTS

No interface ports were cabled during testing to simulate the typical use of the device as a hand-held device.

EUT OPERATION

The EUT was operating with the following software. The software is secured by binary encryption to prevent the user from disabling the DFS function.

Client Device: V4.6.0.12 (Platform 4.0.0.50)

During the channel moving tests the system was configured with an FTP transfer of a video file from the master device (sourced by the PC connected to the master device via an Ethernet interface) to the client device.

The FTP file transferred was the “FCC” test file and the client device was configured with 24mb/sec data rate to achieve a 26% traffic load as approved by the FCC. Further details are provided in Appendix B and in Appendix C

TEST RESULTS

TEST RESULTS SUMMARY – FCC Part 15, CLIENT DEVICE

Table 1 FCC Part 15 Subpart E Client Device Test Result Summary						
Description	Radar Type	Radar Frequency	Measured Value	Requirement	Test Data	Status
Channel closing transmission time	Type 1	5280MHz	0.5ms	<60ms	Appendix B	Complies
Channel move time	Type 1	5280MHz	0.539s	<10s	Appendix B	Complies
Non-occupancy period - associated	Type 1	5320MHz	>30 minutes	> 30 minutes	Appendix B	Complies
Non-occupancy period – not associated	N/A	N/A	No transmissions observed	Passive Scanning	Appendix B	Complies

Notes:

1) Tests were performed using the radiated test method.
2) Channel availability check, detection threshold and non-occupancy period are not applicable to client devices.

MEASUREMENT UNCERTAINTIES

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level, with a coverage factor (k=2) and were calculated in accordance with UKAS document LAB 34.

Measurement	Measurement Unit	Expanded Uncertainty
Timing (Channel move time, aggregate transmission time)	ms	Timing resolution +/- 0.24%
Timing (non occupancy period)	seconds	5 seconds
DFS Threshold (radiated)	dBm	1.6
DFS Threshold (conducted)	dBm	1.2

DFS TEST METHODS

RADIATED TEST METHOD

The combination of master and slave devices is located in an anechoic chamber. The simulated radar waveform is transmitted from a directional horn antenna (typically an EMCO 3115) toward the unit performing the radar detection (radar detection device, RDD). Every effort is made to ensure that the main beam of the EUT's antenna is aligned with the radar generating antenna.

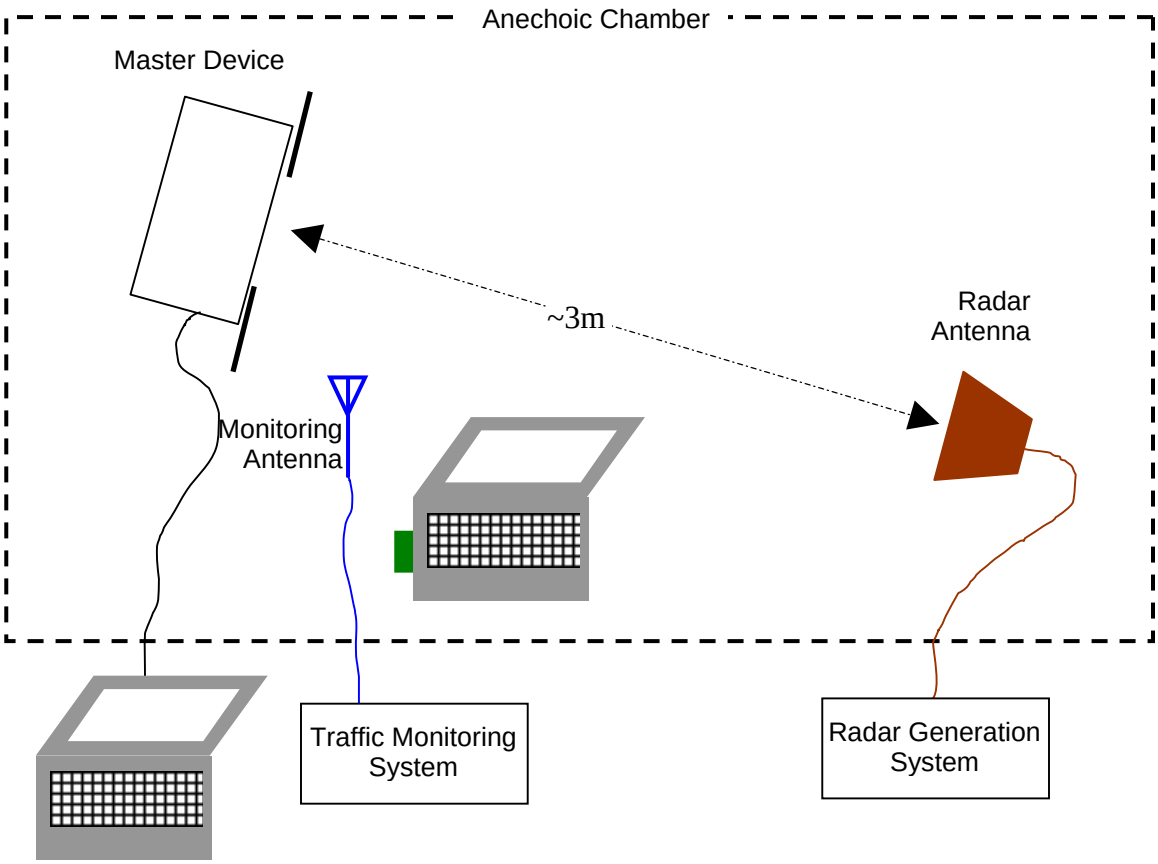

Figure 1 Test Configuration for radiated Measurement Method

The signal level of the simulated waveform is set to a reference level equal to the threshold level (plus 1dB if testing against FCC requirements). Lower levels may also be applied on request of the manufacturer. The level reported is the level at the RDD antenna and so it is not corrected for the RDD's antenna gain. The RDD is configured with the lowest gain antenna assembly intended for use with the device.

The signal level is verified by measuring the CW signal level from the radar generation system using a reference antenna of gain G (dBi). The radar signal level is calculated from the measured level, R (dBm), and any cable loss, L (dB), between the reference antenna and the measuring instrument:

Applied level (dBm) = R – GREF + L

If both master and client devices have radar detection capability then the device not under test is positioned with absorbing material between its antenna and the radar generating antenna, and the radar level at the non RDD is verified to be at least 20dB below the threshold level to ensure that any responses are due to the RDD detecting radar.

The antenna connected to the channel monitoring subsystem is positioned to allow both master and client transmissions to be observed, with the level of the EUT's transmissions between 6 and 10dB higher than those from the other device.

The combination of master and slave devices is located in an anechoic chamber. The simulated radar waveform is coupled into the unit performing the radar detection (radar detection device, RDD) via couplers and attenuators.

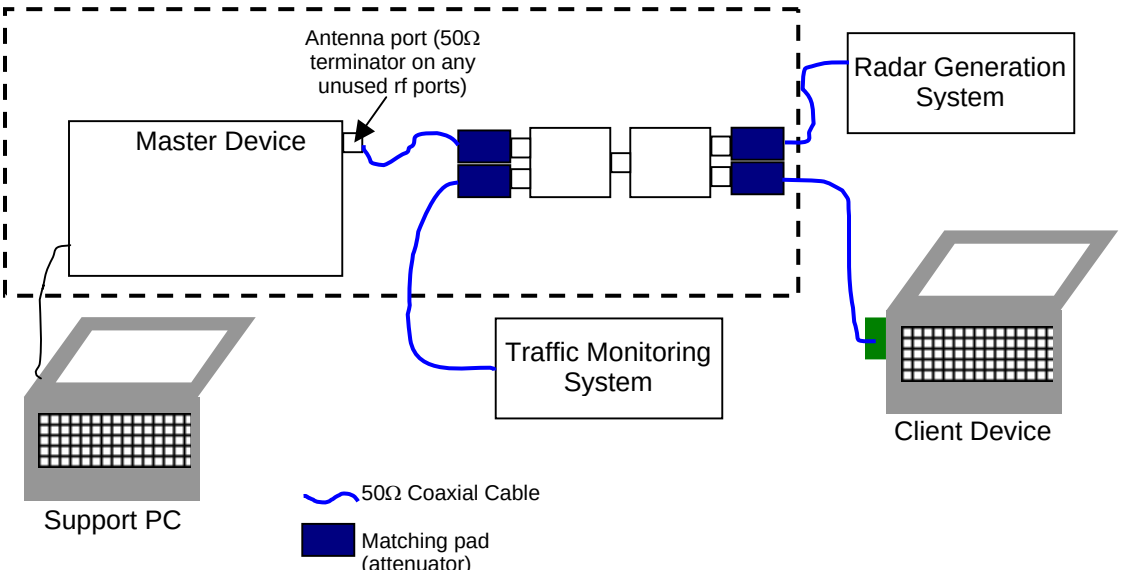

Figure 2 Test Configuration for Conducted Measurement Method

The signal level of the simulated waveform is set to a reference level equal to the threshold level (plus 1dB if testing against FCC requirements). Lower levels may also be

applied on request of the manufacturer.

The signal level is verified by measuring the CW signal level at the coupling point to the RDD antenna port. The radar signal level is calculated from the measured level, R (dBm) and the lowest gain antenna assembly intended for use with the RDD, GRDD (dBi):

Applied level (dBm) = R - GRDD

If both master and client devices have radar detection capability then the radar level at the non RDD is verified to be at least 20dB below the threshold level to ensure that any responses are due to the RDD detecting radar.

The antenna connected to the channel monitoring subsystem is positioned to allow both master and client transmissions to be observed, with the level of the EUT's transmissions between 6 and 10dB higher than those from the other device.

DFS MEASUREMENT INSTRUMENTATION

RADAR GENERATION SYSTEM

An Agilent PSG is used as the radar-generating source. The integral arbitrary waveform generators are programmed using Agilent's "Pulse Building" software and Elliott custom software to produce the required waveforms, with the capability to produce both un-modulated and modulated (FM Chirp) pulses. Where there are multiple values for a specific radar parameter then the software selects a value at random and, for FCC tests, the software verifies that the resulting waveform is truly unique.

With the exception of the hopping waveforms required by the FCC's rules (see below), the radar generator is set to a single frequency within the radar detection bandwidth of the EUT.

Frequency hopping radar waveforms are simulated using a time domain model. A randomly hopping sequence algorithm (which uses each channel in the hopping radar's range once in a hopping sequence) generates a hop sequence. A segment of the first 100 elements of the hop sequence are then examined to determine if it contains one or more frequencies within the radar detection bandwidth of the EUT. If it does not then the first element of the segment is discarded and the next frequency in the sequence is added. The process repeats until a valid segment is produced. The radar system is then programmed to produce bursts at time slots coincident with the frequencies within the segment that fall in the detection bandwidth. The frequency of the generator is stepped in 1 MHz increments across the EUT's detection range.

The radar signal level is verified during testing using a CW signal with the AGC function switched on. Correction factors to account for the fact that pulses are generated with the AGC functions switched off are measured annually and an offset is used to account for this in the software.

The generator output is connected to the coupling port of the conducted set-up or to the radar-generating antenna.

CHANNEL MONITORING SYSTEM

Channel monitoring is achieved using a spectrum analyzer and digital storage oscilloscope. The analyzer is configured in a zero-span mode, center frequency set to the radar waveform's frequency or the center frequency of the EUT's operating channel. The IF output of the analyzer is connected to one input of the oscilloscope.

A signal generator output is set to send either the modulating signal directly or a pulse gate with an output pulse co-incident with each radar pulse. This output is connected to a second input on the oscilloscope and the oscilloscope displays both the channel traffic (via the if input) and the radar pulses on its display.

For in service monitoring tests the analyzer sweep time is set to > 20 seconds and the oscilloscope is configured with a data record length of 10 seconds for the short duration and frequency hopping waveforms, 20 seconds for the long duration waveforms. Both instruments are set for a single acquisition sequence. The analyzer is triggered 500ms before the start of the waveform and the oscilloscope is triggered directly by the modulating pulse train. Timing measurements for aggregate channel transmission time and channel move time are made from the oscilloscope data, with the end of the waveform clearly identified by the pulse train on one trace. The analyzer trace data is used to confirm that the last transmission occurred within the 10-second record of the oscilloscope. If necessary the record length of the oscilloscope is expanded to capture the last transmission on the channel prior to the channel move.

Channel availability check time timing plots are made using the analyzer. The analyzer is triggered at start of the EUT's channel availability check and used to verify that the EUT does not transmit when radar is applied during the check time.

The analyzer detector and oscilloscope sampling mode is set to peak detect for all plots.

DFS MEASUREMENT METHODS

DFS – CHANNEL CLOSING TRANSMISSION TIME AND CHANNEL MOVE TIME

Channel clearing and closing times are measured by applying a burst of radar with the device configured to change channel and by observing the channel for transmissions. The time between the end of the applied radar waveform and the final transmission on the channel is the channel move time.

The aggregate transmission closing time is measured in one of two ways:

FCC – the total time of all individual transmissions from the EUT that are observed starting 200ms at the end of the last radar pulse in the waveform. This value is required to be less than 60ms.

ETSI[1] – the total time of all individual transmissions from the EUT that are observed from the end of the last radar pulse in the waveform. This value is required to be less than 260ms.

DFS – CHANNEL NON-OCCUPANCY AND VERIFICATION OF PASSIVE SCANNING

The channel that was in use prior to radar detection by the master is additionally monitored for 30 minutes to ensure no transmissions on the vacated channel over the required non-occupancy period. This is achieved by tuning the spectrum analyzer to the vacated channel in zero-span mode and connecting the IF output to an oscilloscope. The oscilloscope is triggered by the radar pulse and set to provide a single sweep (in peak detect mode) that lasts for at least 30 minutes after the end of the channel move time.

For devices with a client-mode that are being evaluated against FCC rules the complete spectrum of operation requiring DFS is monitored for a period of 30 minutes with the master device switched off to verify that the client device does not employ any active scanning techniques (i.e. does not transmit in the DFS bands without authorization from a Master device). This is achieved by tuning the spectrum analyzer to the master's operating channel in zero-span mode and connecting the IF output to an oscilloscope. The oscilloscope is manually triggered once the master has powered down to provide a single sweep (in peak detect mode) that lasts for at least 30 minutes after the end of the channel move time.

[1] This measurement method is used for MIC Table No. 45.

DFS CHANNEL AVAILABILITY CHECK TIME

It is preferred that the EUT report when it starts the radar channel availability check. If the EUT does not report the start of the check time, then the time to start transmitting on a channel after switching the device on is measured to approximate the time from power-on to the end of the channel availability check. The start of the channel availability check is assumed to be 60 seconds prior to the first transmission on the channel.

To evaluate the channel availability check, a single burst of one radar type is applied within the first 2 seconds of the start of the channel availability check and it is verified that the device does not use the channel by continuing to monitor the channel for a period of at least 60 seconds. The test is repeated by applying a radar burst in the last 2 seconds (i.e. between 58 and 60 seconds after the start of CAC) of the channel availability check.

TRANSMIT POWER CONTROL (TPC)

Compliance with the transmit power control requirements for devices is demonstrated through measurements showing multiple power levels and manufacturer statements explaining how the power control is implemented.

SAMPLE CALCULATIONS

DETECTION PROBABILITY / SUCCESS RATE

The detection probability, or success rate, for any one radar waveform equals the number of successful trials divided by the total number of trials for that waveform.

THRESHOLD LEVEL

The threshold level is the level of the simulated radar waveform at the EUT's antenna. If the test is performed in a conducted fashion then the level at the rf input equals the level at the antenna plus the gain of the antenna assembly, in dBi. The gain of the antenna assembly equals the gain of the antenna minus the loss of the cabling between the rf input and the antenna. The lowest gain value for all antenna assemblies intended for use with the device is used when making this calculation.

If the test is performed using the radiated method then the threshold level is the level at the antenna.

Appendix A Test Equipment Calibration Data

Manufacturer	Description	Model #	Asset #	Cal Due
Hewlett Packard	Spectrum Analyzer	8595EM	780	09-Oct-08
Tektronix	Digital Oscilloscope	TDS 5104	1435	26-Apr-08
Agilent Technologies	PSG Vector Signal Generator	E8267C	1877	15-Feb-10
EMCO	1-18GHz Horn Antenna	3115	868	24-Apr-08
ETS Lindgren	1-18GHz Horn Antenna	3117	1662	11-Apr-10

Appendix B Test Data Tables and Plots for Channel Closing

CHANNEL UTILIZATION

The plot below shows the channel loading during testing as evaluated over a 1 second period. As the client device was unable to use the Windows Media Player the FCC-recommended method for loading a canel during testing could not be employed. Traffic from master to client device was generated using FTP protocol to transfer a large file (mpeg file) while restricting the access point to a 24Mb/sec data rate. A one-second plot of channel traffic with a resolution of 40us demonstrated a traffic loading of 26.7%. Refer also to Appendix C

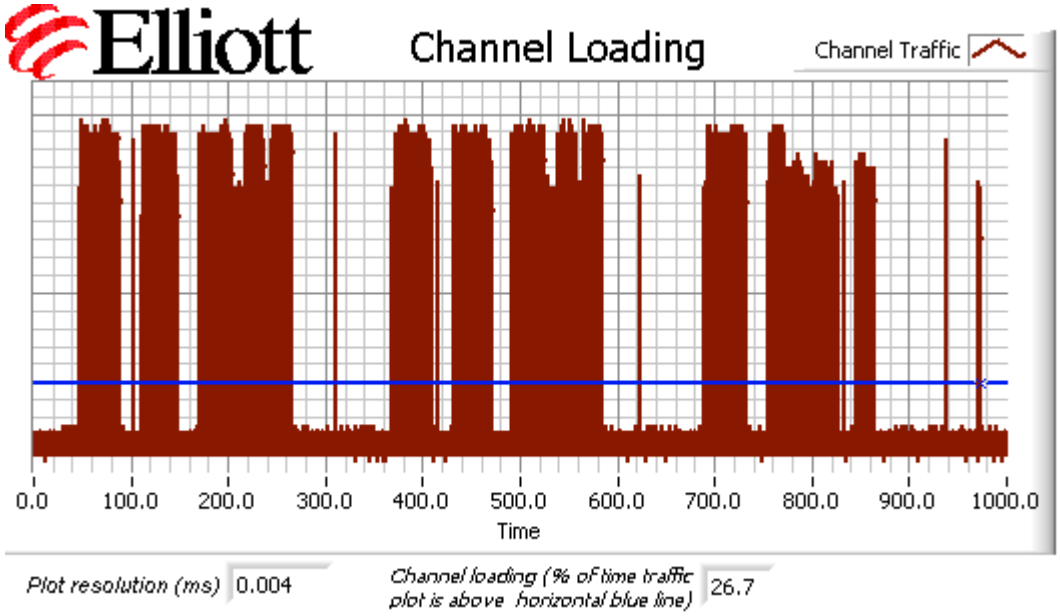

Figure 3 Channel Utilization During Channel Closing Measurements

FCC PART 15 SUBPART E Channel Closing Measurements

Table 2 FCC Part 15 Subpart E Channel Closing Test Results					
Waveform Type	Channel Closing Transmission Time [1]		Channel Move Time		Result
	Measured	Limit	Measured	Limit	
Radar Type 1	0.5 ms	60 ms	.539 s	10 s	Complies

After the final channel closing test the channel was monitored for a further 30 minutes. No transmissions occurred on the channel.

[1] Channel closing time for FCC measurements is the aggregate transmission time starting from 200ms after the end of the radar signal to the completion of the channel move.

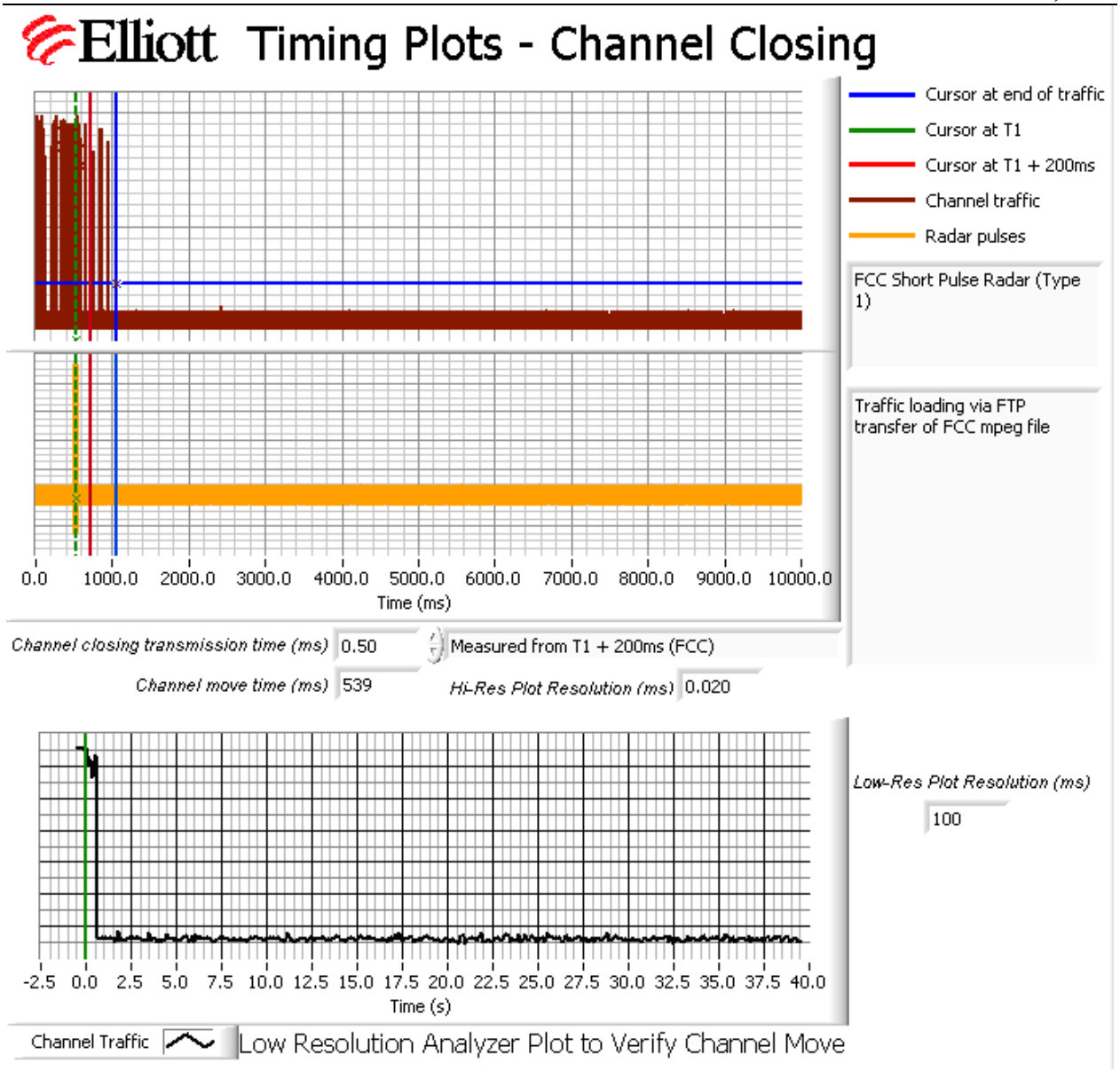

Figure 4 Channel Closing Time and Channel Move Time – 40 second plot

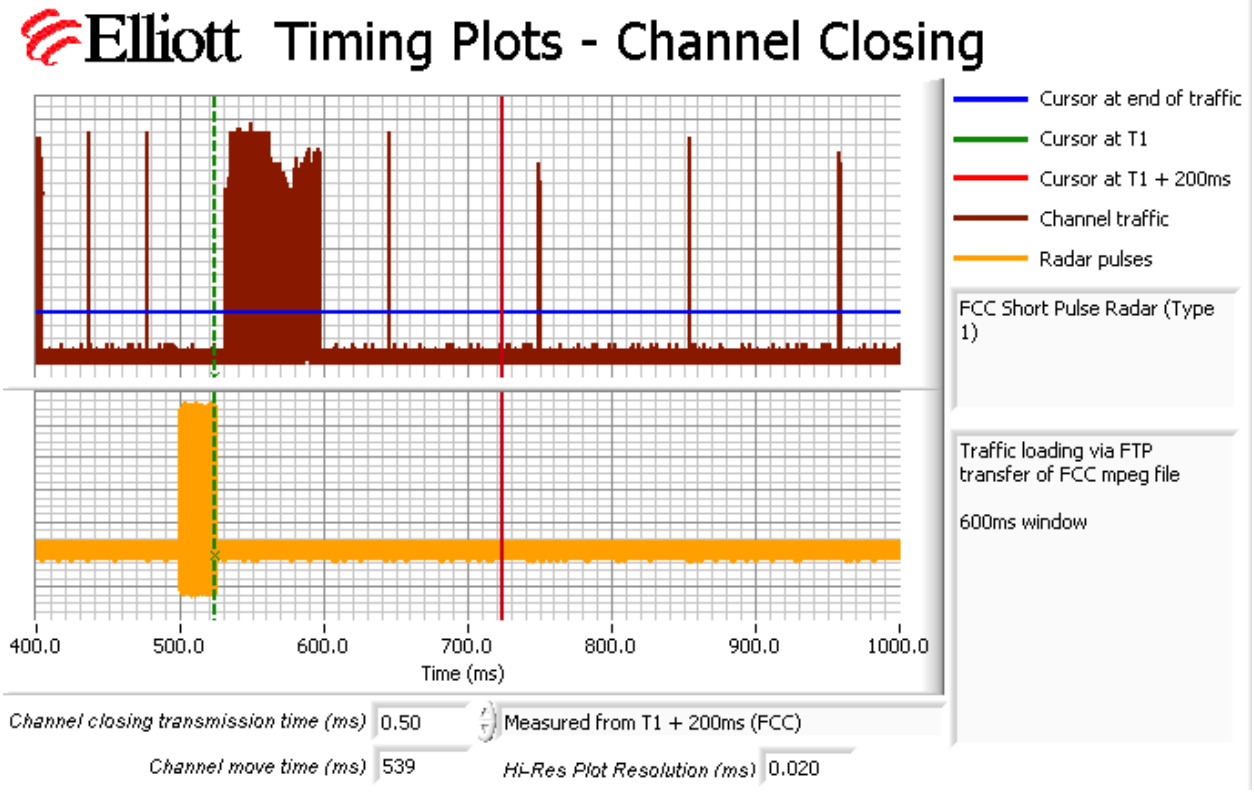

Figure 5 Close-Up of Transmissions Occurring More Than 200ms After The End of Radar

There were three sets of transmissions with a total transmission time of 500us, consistent with short duration control signals rather than data signals.

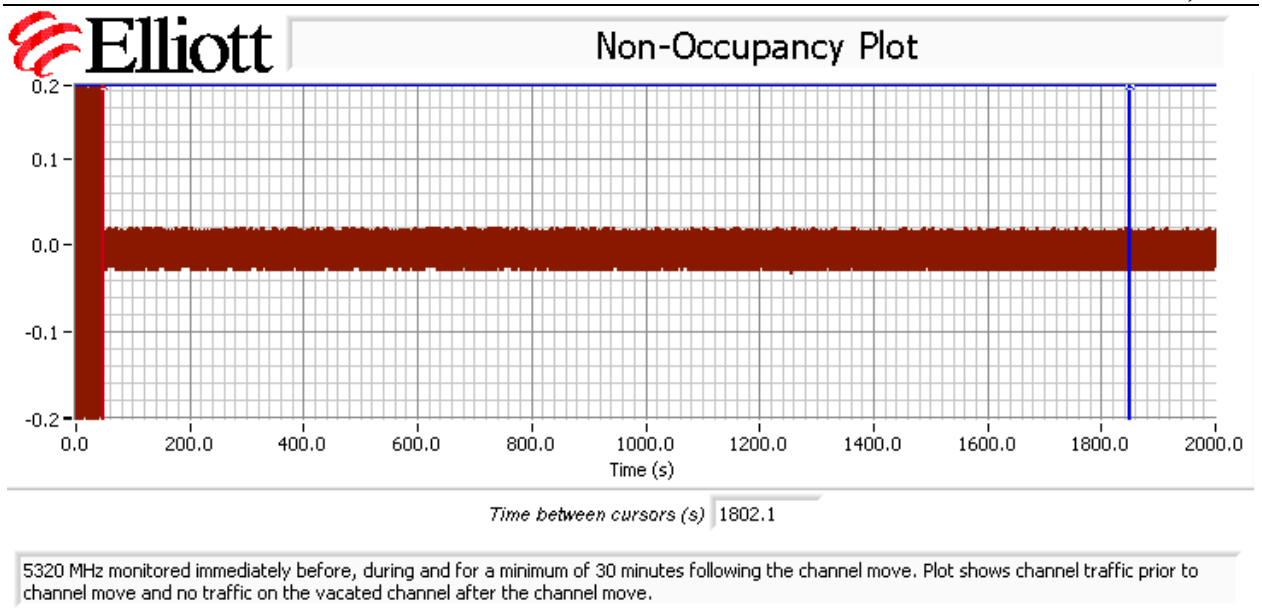

Figure 6 Radar Channel Non-Occupancy Plot

The non-occupancy plot was made over a 30-minute time period following the channel move time with the analyzer IF output connected to the scope and tuned to the vacated channel. No transmissions were observed after the channel move had been completed.

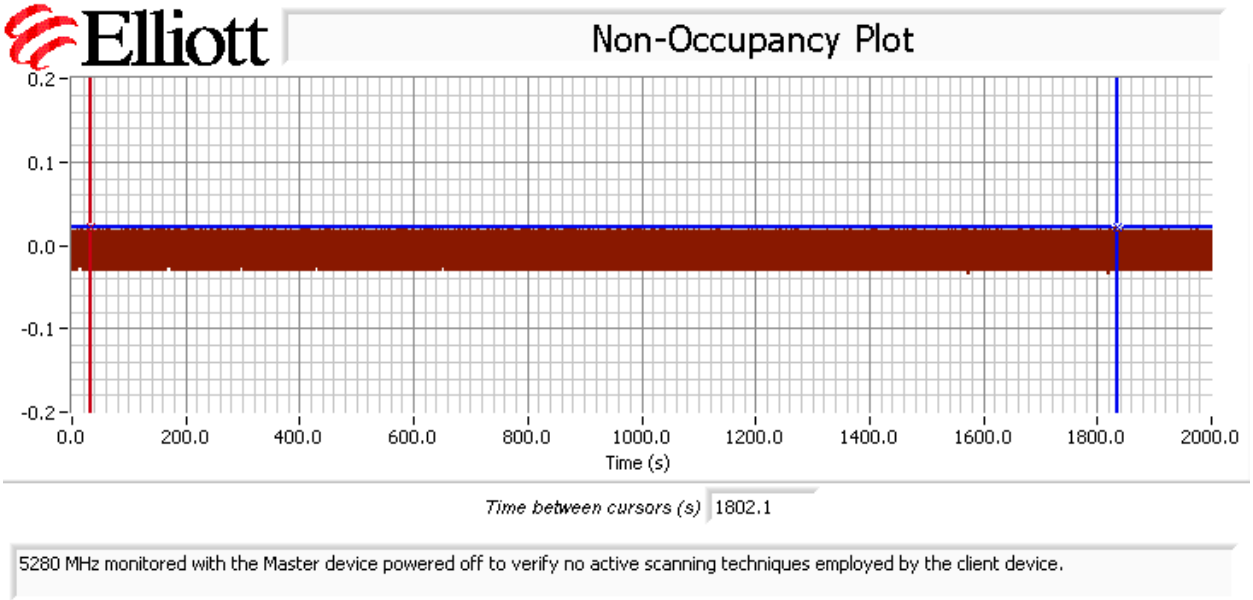

Figure 7 Confirmation of Passive Scanning For Client Devices (Non-associated Test)

The plot used to verify passive scanning in the non-associated non-occupancy test was made over a 30-minute time period with the analyzer IF output connected to the scope and tuned to the previously occupied channel to confirm that there were no transmissions from the Client device with the Master device powered off. No transmissions were observed.

Appendix C EUT Operational Details

The following information was submitted to the FCC to justify the use of the ftp file transfer mechanism to generate traffic in lieu of the standard MPEG file transfer via a specific media player. Measurements of channel loading were made during testing and are included in Appendix B

Discussions on Dynamic Frequency Selection (DFS) Requirement of FCC Part 15, Subpart E(UNII) test plan deviation for BlackBerry model RBT71UW, FCC ID L6ARBT70UW, Dual-Mode Cellular Wi-Fi Smartphone with no video streaming capabilities

Research In Motion Limited (RIM) proposed the following deviation from the standard DFS test plan outlined in FCC-06-96

1. Sec. 7.7. For devices with no video streaming capabilities, use FTP to enable the wireless transfer of the MPEG video test file from the server/computer to the client UUT via the FCC certified Access Point.
2. Sec. 7.7.1. The FTP server will run on master for all test configurations.
3. Sec. 7.7.2.
   - Ensure that the Certified Master AP is set to 6Mbps data rate for maximum RF loading of 21% at 0.11 the rate of 6Mbps for the FTP TCP payload of 1400 byte, and an average throughput 130KBps.
   - Start the FTP server on the master device.
   - Start the FTP client on the UUT. The UUT will download the reference movie at a speed that ensures in excess of 13 minutes of stated channel load.
   - Commands for the FTP server and client will be provided as part of the testing instructions for the UUT.

Product Information

Dual-Mode Cellular Wi-Fi (802.11abg) Smartphone without radar detection operating in the 5GHZ 802.11a

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Discussions:

Since the UUT is an Application Specific Device (ASD) rather than a General Purpose laptop PC, streaming the MPEG test file to the Smartphone was not possible.

Since the UUT is not capable or fully loading a 54Mb/s data rate channel a lower data rate was chosen.

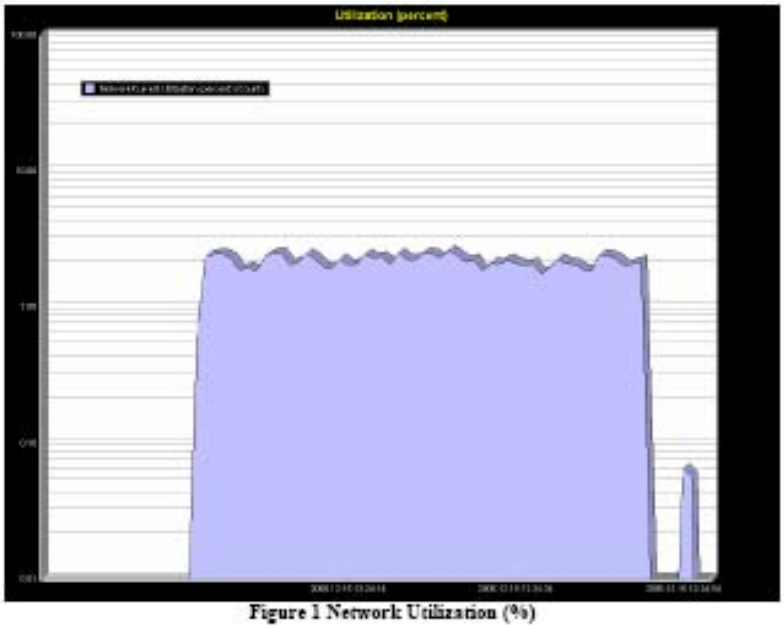

Figure 1 Network Utilization (%)

RIM examined the throughput of an IBM ThinkPad laptop receiving the streaming test video to determine network utilization pattern and capacity, see Fig 1. The sending AP was limited to the lowest data rate of 6Mb/s. The captured traces indicated HTTP (TCP) traffic using large (1536 byte) packets with an average IP network utilization of 12%, sufficient to sustain the streaming content without jitter or video "stutter". RIM made the decision to limit the AP data rate to 6Mb/s

RIM chose the FTP application that can run on its device and duplicate this IP network utilization. The FTP application uses TCP and large data packets. The next step was to confirm that the 6Mb/s data rate corresponded to an RF loading of 21%.

RIM selected the lowest data rate in the 802.11a band, 6Mbps. This rate is the least efficient OFDM rate and tends to have the highest RF loading. And given the lower bandwidth that a Dual

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Mode Cellular Wi-Fi uses, any higher data will not likely create the same RF loading as shown in Fig. 2.

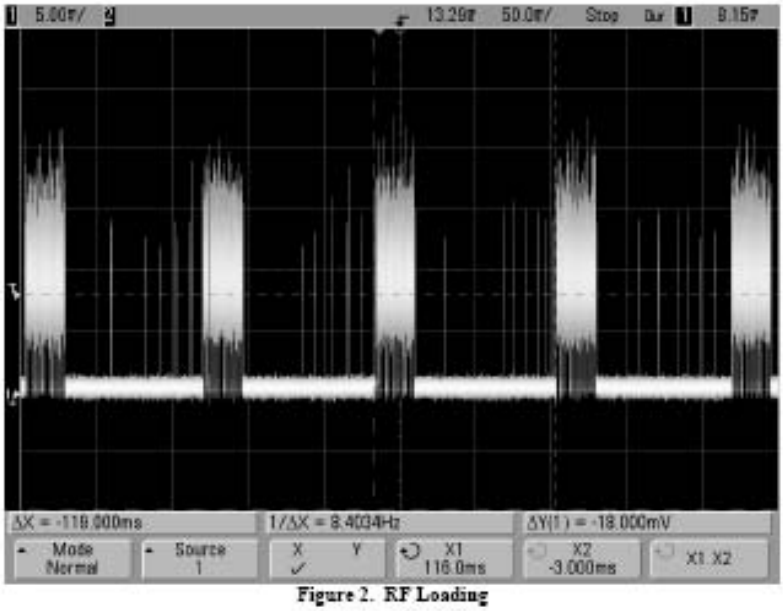
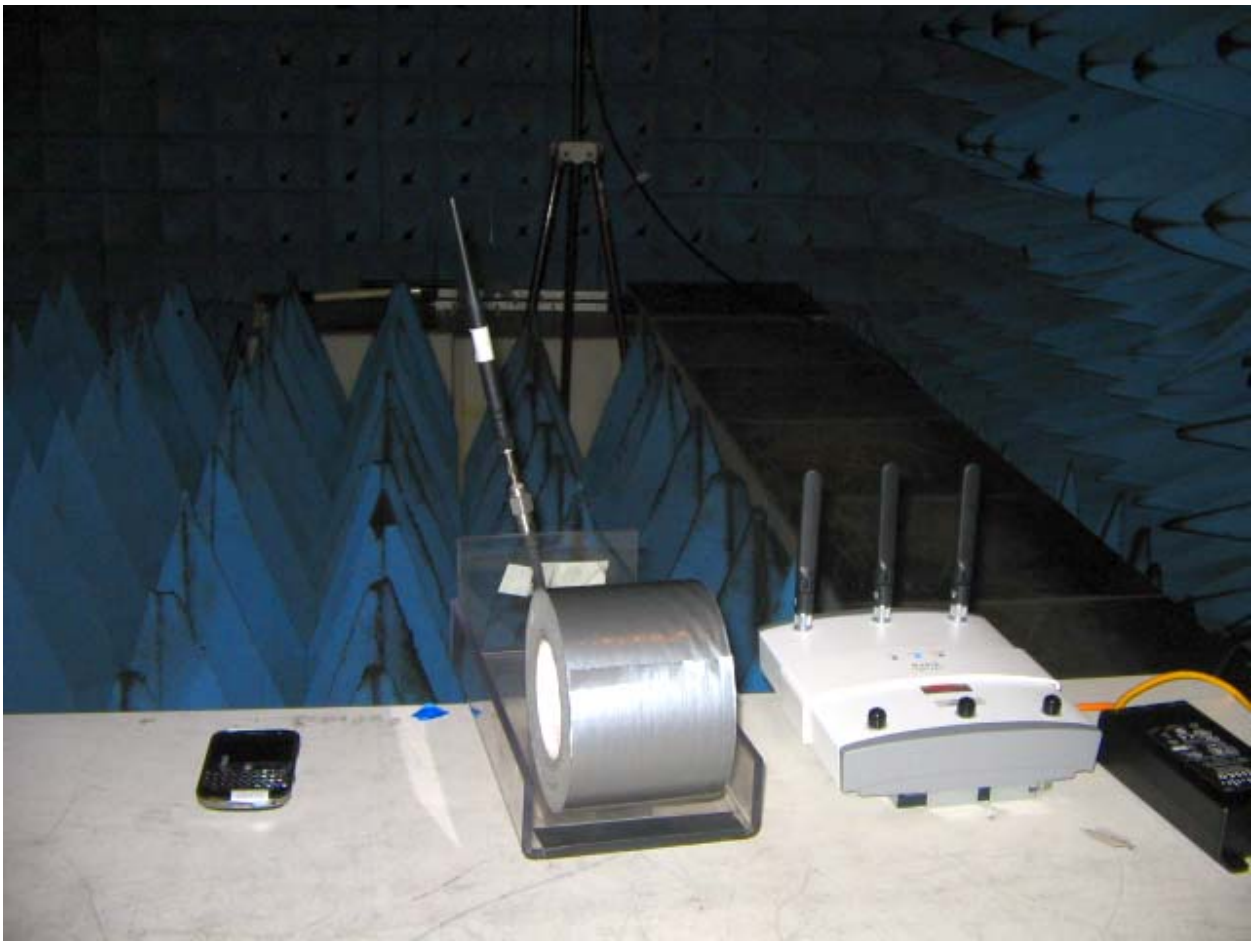
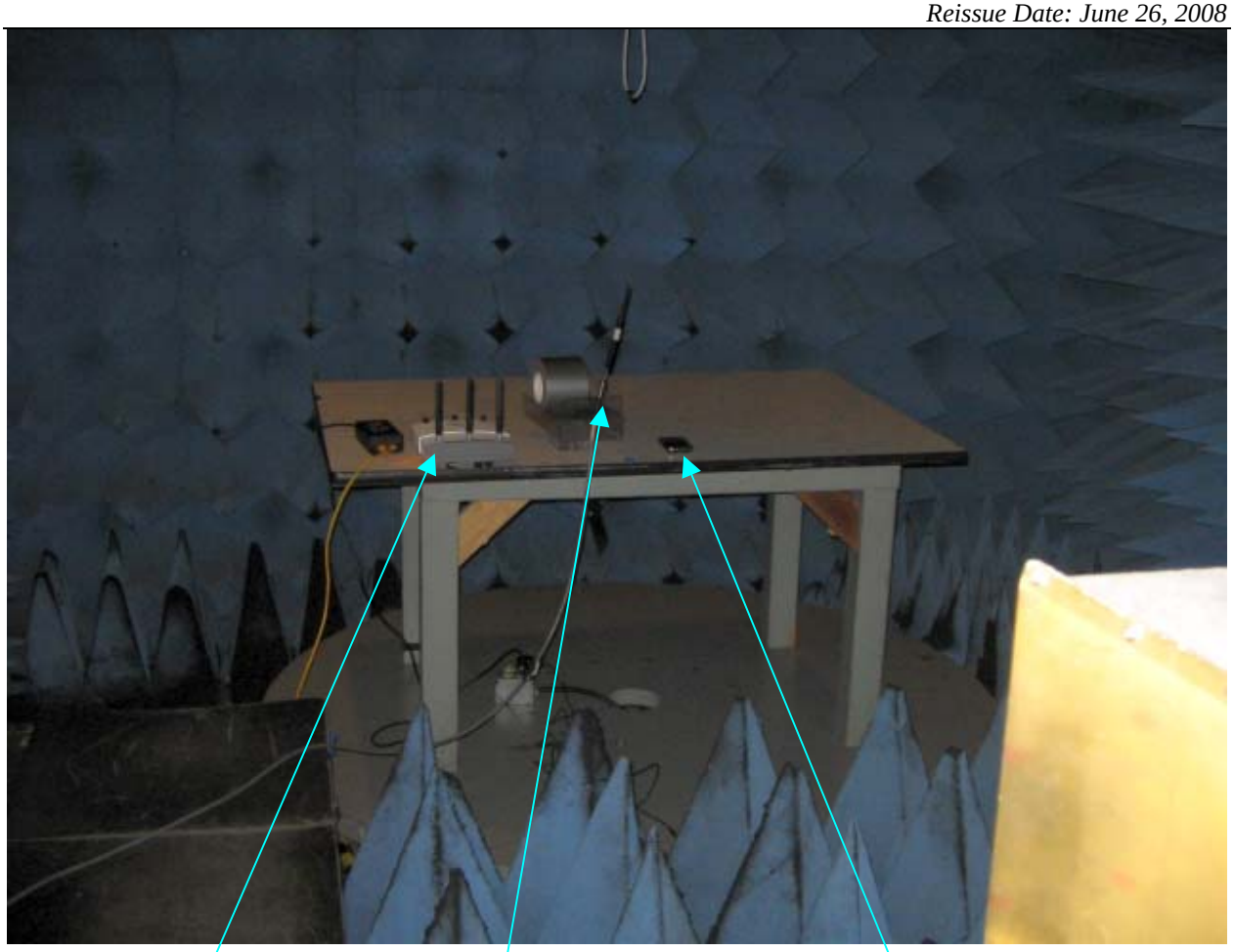


Figure 2. RF Loading

Appendix D Test Configuration Photographs




Master Device
Traffic monitoring antenna
EUT (Client Device)