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TEST REPORT
DYNAMIC FREQUENCY SELECTION REQUIREMENTS
OF

FCC Part 15 Subpart E (UNII)

Research In Motion Limited (RIM)
Model: RBG41GW
FCC ID: L6ARBG40GW

COMPANY:	Research in Motion 305 Phillip Street Waterloo, Ontario N2L 3W8 Canada
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Ave Sunnyvale, CA 94086
REPORT DATE:	January 8, 2007
RE-ISSUE DATE:	March 30, 2007
FINAL TEST DATE:	March 27, 2007
AUTHORIZED SIGNATORY:	David W. Bare Chief Technical Officer

ACCREDITED
2016-01

REVISION HISTORY

Revision #	Date	Comments	Modified By
1	January 8, 2007	Original report	-
2	March 30, 2007	Modifed report for new test performed on March 27 using different channel loading via ftp methods and a different sample	jm

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LIST OF FIGURES AND TABLES

SCOPE

The Federal Communications Commission publishes standards regarding ElectroMagnetic Compatibility for radio-communications devices. Tests have been performed on the Research In Motion Limited (RIM) model RBG41GW in accordance with one of these standards.

Test data has been taken pursuant to the relevant DFS requirements of the following standard(s):

- 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 Limited (RIM) model RBG41GW and therefore apply only to the tested sample. The sample was selected and prepared by Masud Attayi of Research in Motion Limited (RIM).

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 Limited (RIM) model RBG41GW complied with the DFS requirements for a client device without radar detection capabilities of:

FCC Part 15.407(h)

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 following deviations were made from the test methods and requirements covered by the scope of this report:

1. Used FTP to enable the wireless transfer of the MPEG video test file from the server/computer to the client EUT via the FCC certified Access Point. The EUT did not have to play the MPEG file since it did not have video streaming capabilities.

2. The certified master AP was set to a constant 6 Mb/s rate by using Cisco web browser menu options under the 802.11a radio. The Data rate was set to 6 Mb/s as a default when it had completed its boot sequence.

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Research In Motion Limited (RIM) model RBG41GW is a handheld organizer and cellular phone with WiFi capabilities.

The sample was received on March 8, 2007 and tested on March 27, 2007. The EUT consisted of the following component(s):

Manufacturer	Model	Description	Serial Number
Research in Motion	RBG41GW	Handheld organizer and cellular phone	Pre-production

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

Operating Modes

☐ Master Device

☒ Client Device with no radar detection

☐ Client Device with In-Service Monitoring

Antenna Gains / EIRP

	5250 – 5350 MHz	5470 – 5725 MHz
Lowest Antenna Gain (dBi)	3	0.85
Highest Antenna Gain (dBi)	3.5	2
Output Power (dBm)	18	18

☐ Power can exceed 200mW eirp

Channel Protocol

☒ IP Based

☐ Frame Based

☐ OTHER _____

ENCLOSURE

The EUT enclosure measures approximately 11 by 6.5 by 1 centimeter. 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	*AIR-AP1131AG-A-K9*	*Access Point*	*FTX1040T17J*	*LDK102054E*
Dell	PP02X	Laptop with wireless card	42707742661	DoC

The italicized device was the master device. ***(Note: The master AP was forced to 6Mbps using Cisco web browser access to the AP which in turn has menu options under the 802.11a to be able to set the data rate to 6Mbps as a default when it has completed its boot sequence.)***

EUT INTERFACE PORTS

The I/O cabling configuration during testing was as follows:

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
None				

EUT OPERATION

The EUT was operating with the following software:

Client Device: Wireless Handheld v4.2.2.35 (platform 2.4.0.13)

During the channel moving tests the system was configured with a streaming video file from the master device (sourced by a server connected to the master device via an Ethernet interface) to the laptop.

The streamed file was the "FCC" test MPEG file and the PDA blackberry was using the FTP method, FCC accepted, to provide the channel loading.

TEST RESULTS

TEST RESULTS SUMMARY – FCC Part 15, CLIENT DEVICE

Description	Radar Type	Radar Frequency	Measured Value	Requirement	Test Data	Status
Channel closing transmission time	Type 1	5300 MHz	0.82mS	60mS	Appendix C	Passed
Channel move time	Type 1	5300 MHz	0.434S	10 S	Appendix C	Passed

Table 1 FCC Part 15 Subpart E Client Device Test Result Summary

Notes:

1) Channel availability check, detection threshold and non-occupancy period are not applicable to client devices.

Waveform Name	Success Rate	Number of Trials
FCC Short Pulse Radar (Type 1)	100 %	1

Table 2 Summary of All Results

Trial #	Pulses/Burst	Pulse Width (us)	PRI (us)	Detected ?	Fr (MHz) and level (dBm)	Hop Seq.
Trial #1	18	1	1428	Yes	5300, -64dBm	N/A

Table 3 FCC Short Pulse Radar (Type 1) Test Results

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 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.

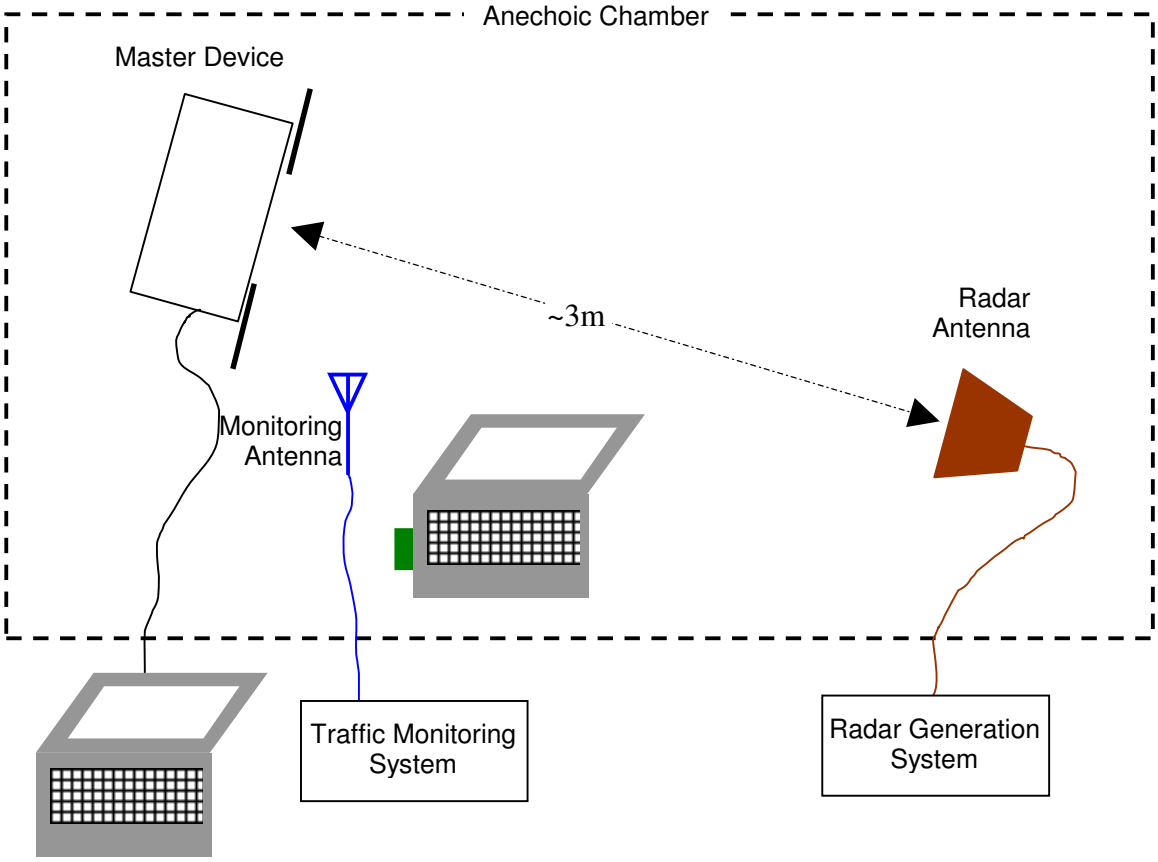

Figure 1 Test Configuration for Radiated Measurement Method

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.

CONDUCTED TEST METHOD

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.

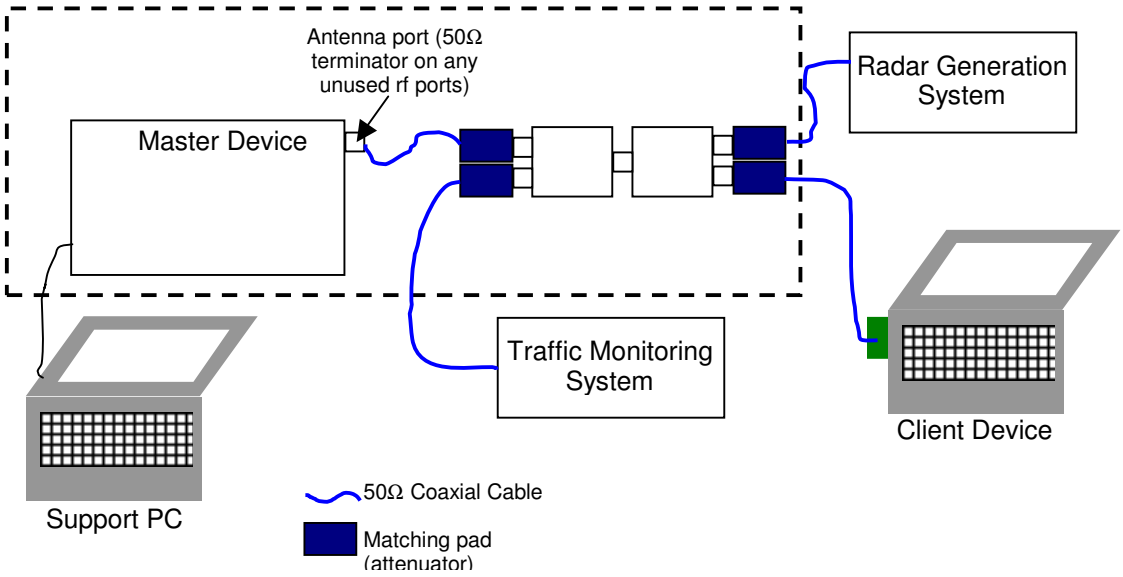

Figure 2 Test Configuration for Conducted Measurement Method

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 noth 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 RADAR DETECTION BANDWIDTH

The radar detection bandwidth is determined by using on of the radar waveforms (in the FCC case, the selection is limited to the short duration burst waveforms) and applying radar pulses at offset from the center channel frequency by multiples of 1MHz. These bursts are applied with no traffic on the channel. The first frequencies above and below the center channel frequency that have a detection rate below 90% define the radar bandwidth, the actual range being 1MHz below the upper frequency and 1MHz above the lower frequency.

DFS – CHANNEL CLOSING TRANSMISSION TIME AND CHANNEL MOVE TIME

Channel clearing and closing times are measured by applying a radar burst 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 as the total time of all individual transmissions from the EUT that are observed starting 200ms after radar detection. This value is required to be less than 60ms.

DFS CHANNEL AVAILABILITY CHECK TIME

It is preferred that the EUT report when it starts the radar channel availability check. In this case a single burst of one radar type is applied within 6 seconds of observing the start of the channel availability check and it is verified that the device does not use the channel. The test is repeated by applying a radar burst no sooner than 54 seconds and no later than 60 seconds after the start of the 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.

UNIFORM LOADING

Compliance with the channel loading requirement, where appropriate (i.e. when channel selection is not determined under control of the network), is demonstrated through the manufacturer's statement(s).

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.

Appendix A Test Equipment Calibration Data

Manufacturer	Description	Model #	Asset #	Cal Due
Hewlett Packard	EMC Spectrum Analyzer, 9 kHz - 6.5 GHz	8595EM	780	05-Sep-07
Tektronix	1 GHz Oscilloscope	TDS5104	1435	10-Apr-07
EMCO	Antenna, Horn, 1-18 GHz	3117	1662	07-Apr-07
Agilent	Vector Signal Generator (250kHz - 20GHz)	E8267C	1877	23-Nov-07

Appendix B Test Data Tables for Radar Detection

The plot below shows the channel loading during testing as evaluated over a 1 second period. The traffic was generated by sending a streaming video file from the master device (sourced by a server connected to the master device via an Ethernet interface) to the EUT via FTP connection approved by the FCC.

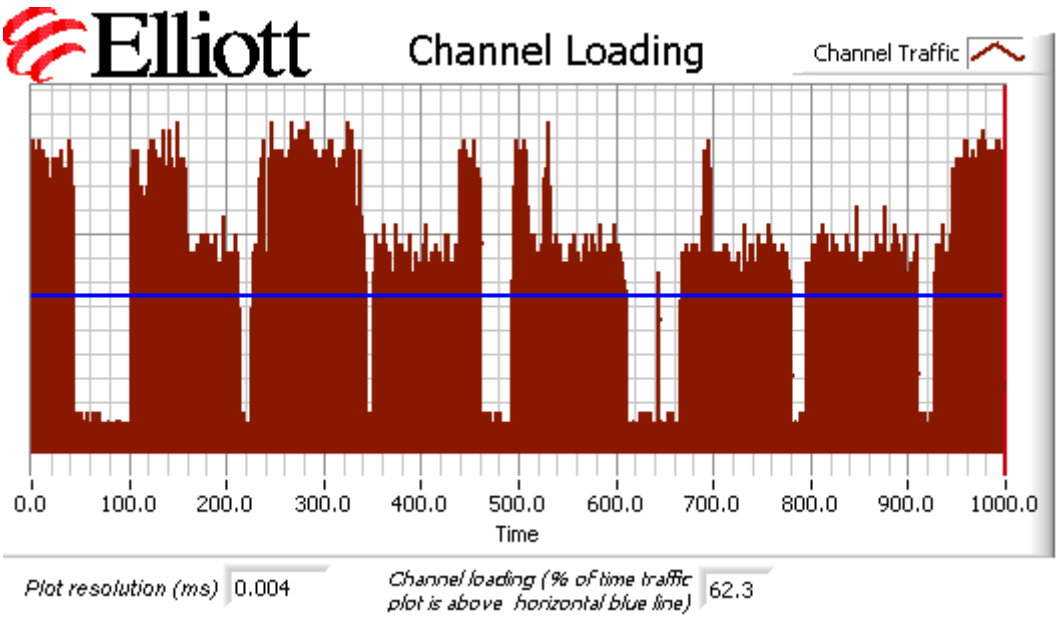

Figure 3 Channel Utilization During In-Service Detection Measurements

Appendix C Test Data Tables and Plots for Channel Closing

FCC PART 15 SUBPART E DATA

Waveform Type	Channel Closing Transmission Time [1]		Channel Move Time		Result
	Measured	Limit	Measured	Limit	
Radar Type 1	0.82 ms	60 ms	0.434 s	10 s	Pass

Table 4 FCC Part 15 Subpart E Channel Closing Test Results

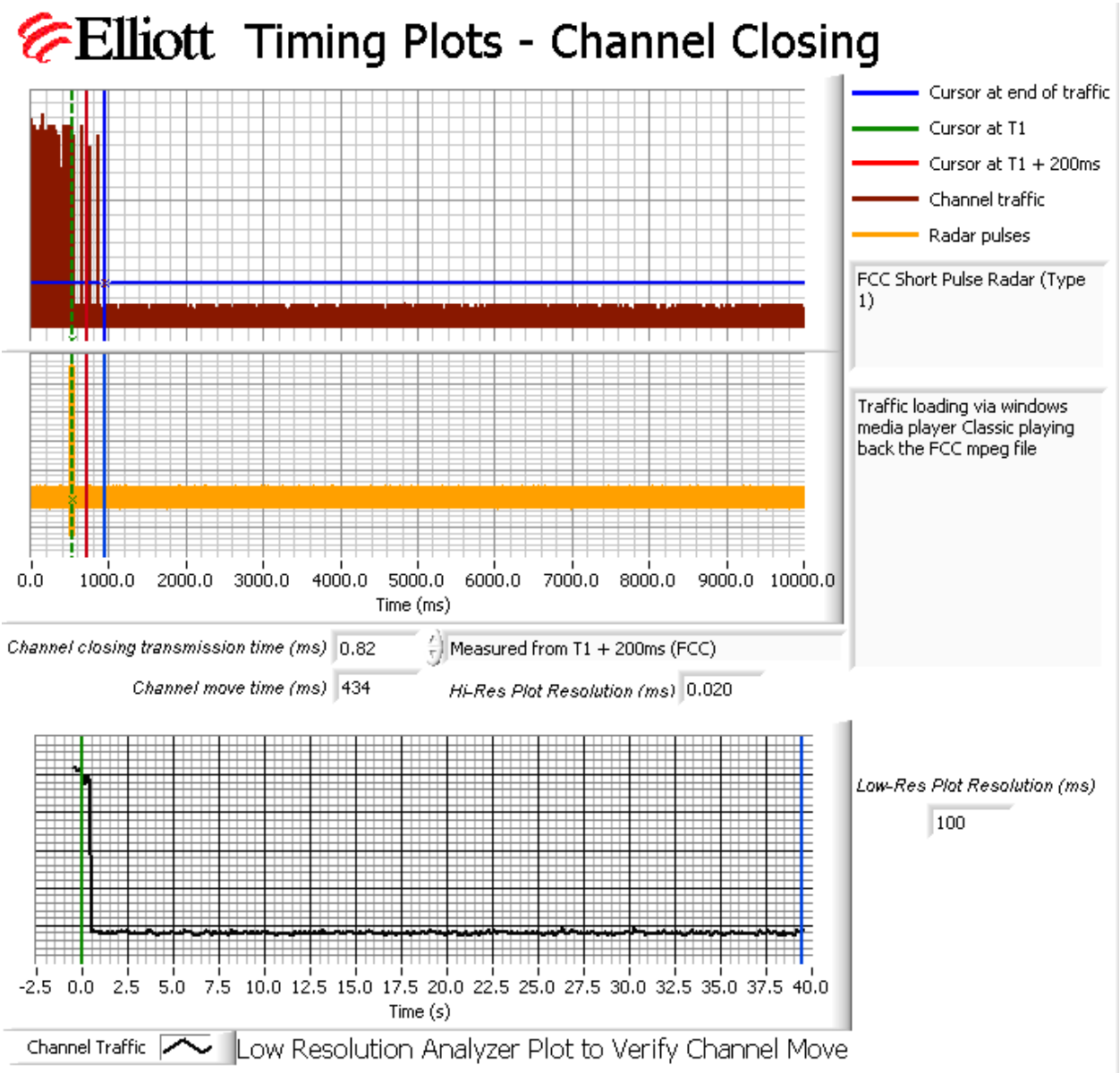

Figure 4 – Channel closing

[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. The ETSI requirement is less restrictive on when the 260mS of transmissions can occur.

Figure 5 – Zoomed plot of channel closing

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