EMC Test Report
Application for Grant of Equipment Authorization
Industry Canada RSS-Gen Issue 3 / RSS 210 Issue 8
FCC Part 15 Subpart C

Model: SDC-MSD40NBT

IC CERTIFICATION #:	6616A-SDCMSD40NBT
FCC ID:	TWG-SDCMSD40NBT
APPLICANT:	Summit Data Communications 526 South Main St. Suite 805 Akron, OH 44311
TEST SITE(S):	Elliott Laboratories 41039 Boyce Road. Fremont, CA. 94538-2435
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REVISION HISTORY

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SCOPE

An electromagnetic emissions test has been performed on the Summit Data Communications model SDC-MSD40NBT, pursuant to the following rules:

Industry Canada RSS-Gen Issue 3
RSS 210 Issue 8 "Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment"
FCC Part 15 Subpart C

Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in the following reference standards and as outlined in Elliott Laboratories test procedures:

ANSI C63.4:2003
FHSS test procedure DA 00-0705A1, March 2000

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant Industry Canada performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

OBJECTIVE

The primary objective of the manufacturer is compliance with the regulations outlined in the previous section.

Prior to marketing in the USA, all unlicensed transmitters and transceivers require certification. Receive-only devices operating between 30 MHz and 960 MHz are subject to either certification or a manufacturer's declaration of conformity, with all other receive-only devices exempt from the technical requirements.

Prior to marketing in Canada, Class I transmitters, receivers and transceivers require certification. Class II devices are required to meet the appropriate technical requirements but are exempt from certification requirements.

Certification is a procedure where the manufacturer submits test data and technical information to a certification body and receives a certificate or grant of equipment authorization upon successful completion of the certification body's review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units, which are subsequently manufactured.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

STATEMENT OF COMPLIANCE

The tested sample of Summit Data Communications model SDC-MSD40NBT complied with the requirements of the following regulations:

Industry Canada RSS-Gen Issue 3
RSS 210 Issue 8 "Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment"
FCC Part 15 Subpart C

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.

The test results recorded herein are based on a single type test of Summit Data Communications model SDC-MSD40NBT and therefore apply only to the tested sample. The sample was selected and prepared by Ron Seide of Summit Data Communications.

DEVIATIONS FROM THE STANDARDS

No deviations were made from the published requirements listed in the scope of this report.

TEST RESULTS SUMMARY

FREQUENCY HOPPING SPREAD SPECTRUM (2400 – 2483.5 MHz)

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.247 (a) (1)	RSS 210 A8.1 (1)	20dB Bandwidth	Basic: 1100kHz EDR: 1400kHz	Channel spacing > 2/3rds 20dB BW	Complies
		Channel Separation	1000kHz		Complies
15.247 (a) (1) (ii)	RSS 210 A8.1 (4)	Number of Channels	Max: 79 Min: 20	15 or more	Complies
15.247 (a) (1) (ii)	RSS 210 A8.1 (4)	Channel Dwell Time (*average time of occupancy)*	The system uses the Bluetooth algorithm and, therefore, meets all requirements for channel utilization.	<0.4 second within a period of 0.4 x number of channels	Complies
15.247 (a) (1)	RSS 210 A8.1 (1)	Channel Utilization		All channels shall, on average, be used equally	Complies
15.247 (b) (3)	RSS 210 A8.4 (2)	Output Power	Basic: 0.1 dBm (1.0 mW) EDR: 2.2 dBm (1.7mW) EIRP = 2.6 mW Note 1	0.125 Watts	Complies
15.247(c)	RSS 210 A8.5	Spurious Emissions – 30MHz – 25GHz	All spurious emissions < -20dBc	< -20dBc	Complies
15.247(c) / 15.209	RSS 210 A8.5 Table 2, 3	Radiated Spurious Emissions 30MHz – 25GHz	50.5dBµV/m @ 2483.5MHz (-3.5dB)	15.207 in restricted bands, all others < -20dBc	Complies
15.247 (a) (1)	RSS 210 A8.1(2)	Receiver bandwidth	Refer to operational description	Shall match the channel bandwidth	Complies
Note 1: EIRP calculated using antenna gain of 2 dBi					

GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS

FCC Rule Part	RSS Rule part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.203	-	RF Connector	EUT uses u.FL connectors	Unique or integral antenna required	Complies
15.207	RSS GEN Table 2	AC Conducted Emissions	31.9dBµV @ 19.501MHz (-18.1dB)	Refer to page 18	Complies
15.109	RSS GEN 7.2.3 Table 1	Receiver spurious emissions	45.5dBµV/m @ 2994.6MHz (-8.5dB)	Refer to page 19	Complies
15.247 (b) (5) 15.407 (f)	RSS 102	RF Exposure Requirements	Refer to MPE calculations in Exhibit 11, RSS 102 declaration and User Manual statements.	Refer to OET 65, FCC Part 1 and RSS 102	Complies
-	RSP 100 RSS GEN 7.1.5	User Manual		Statement required regarding non-interference	Complies
-	RSP 100 RSS GEN 7.1.5	User Manual		Statement for products with detachable antenna	Complies
-	RSP 100 RSS GEN 4.4.1	99% Bandwidth	Basic: 973kHz EDR: 1265kHz	Information only	N/A

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 and were calculated in accordance with UKAS document LAB 34.

Measurement Type	Measurement Unit	Frequency Range	Expanded Uncertainty
RF power, conducted (power meter)	dBm	25 to 7000 MHz	± 0.52 dB
RF power, conducted (Spectrum analyzer)	dBm	25 to 7000 MHz	± 0.7 dB
Conducted emission of transmitter	dBm	25 to 26500 MHz	± 0.7 dB
Conducted emission of receiver	dBm	25 to 26500 MHz	± 0.7 dB
Radiated emission (substitution method)	dBm	25 to 26500 MHz	± 2.5 dB
Radiated emission (field strength)	dBμV/m	25 to 1000 MHz	± 3.6 dB
		1000 to 40000 MHz	± 6.0 dB
Conducted Emissions (AC Power)	dBμV	0.15 to 30 MHz	± 2.4 dB

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Summit Data Communications model SDC-MSD40NBT is an 802.11abgn 1x1 with Bluetooth 2.1 module.

The sample was received on October 19, 2010 and tested on May 4, 16 and 18 and December 16, 2011. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC ID
Summit	SDC-MSD40NBT	802.11abgn 1x with BT	Prototype	TWG-SDCMSD40NBT

OTHER EUT DETAILS

The EUT supports single transmit chain operation.

ANTENNA SYSTEM

Dipole Antenna #1 - 2.4 and 5GHz bands - Larsen, R380.500.314, 1.6dBi (2.4GHz), 5dBi (5GHz)
Dipole Antenna #2 - 2.4 GHz only - Cisco Air-Ant 4941 2dBi(2.4GHz)

In the 2.4GHz range, the Cisco antenna was tested as they represented the highest gain antennas of each available type.

The antenna connects to the EUT via a non-standard u.FL antenna connector, thereby meeting the requirements of FCC 15.203.

ENCLOSURE

The EUT has no enclosure. It is designed to be installed within the enclosure of a host computer.

MODIFICATIONS

No modifications were made to the EUT during the time the product was at Elliott.

SUPPORT EQUIPMENT

The following equipment was used as support equipment for testing:

Company	Model	Description	Serial Number	FCC ID
Delta Electronics	EADP-10BB	AC/DC Adapter	59A401Z9UP42 K	N/A
HP	iPaQ	PDA	2CK702010G	N/A
Lenovo	Inspiron 1545	Laptop Computer (Note 1)	953R2K1	DoC

Note 1 – Used to configure the BT radio and then disconnected

EUT INTERFACE PORTS

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

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
AC/DC Adapter	iPaq	2wire	Unshielded	1.5m
AC/DC Adapter	AC Mains	-	-	-

EUT OPERATION

During testing, the EUT was configured to transmit on a single channel continuously at the maximum power.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken at the test sites listed below. Pursuant to section 2.948 of the FCC's Rules and section 3.3 of RSP-100, construction, calibration, and equipment data has been filed with the Commission and with industry Canada.

Site	Registration Numbers		Location
	FCC	Canada	
Chamber 7	A2LA accreditation	2845B-7	41039 Boyce Road Fremont, CA 94538-2435

ANSI C63.4:2003 recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement. The test site(s) contain separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent requirements of ANSI C63.4:2003.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.4:2003. Measurements are made with the EUT connected to the public power network through a nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment or in a semi-anechoic chamber. The test sites are maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4:2003 guidelines and meet the Normalized Site Attenuation (NSA) requirements of ANSI C63.4:2003.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements. If the repetition frequency of the signal being measured is below 20Hz, peak measurements are made in lieu of Quasi-Peak measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz, unless the signal is pulsed in which case the average (or video) bandwidth of the measuring instrument is reduced to onset of pulse desensitization and then increased.

INSTRUMENT CONTROL COMPUTER

The receivers utilize either a Rohde & Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer run automated data collection programs which control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

A loop antenna is used below 30 MHz. For the measurement range 30 MHz to 1000 MHz either a combination of a biconical antenna and a log periodic or a bi-log antenna is used. Above 1000 MHz, horn antennas are used. The antenna calibration factors to convert the received voltage to an electric field strength are included with appropriate cable loss and amplifier gain factors to determine an overall site factor, which is then programmed into the test receivers or incorporated into the test software.

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height. Measurements below 30 MHz are made with the loop antenna at a fixed height of 1m above the ground plane.

ANSI C63.4:2003 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

EUT AND CABLE PLACEMENT

The regulations require that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4:2003, and the worst-case orientation is used for final measurements.

CONDUCTED EMISSIONS

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

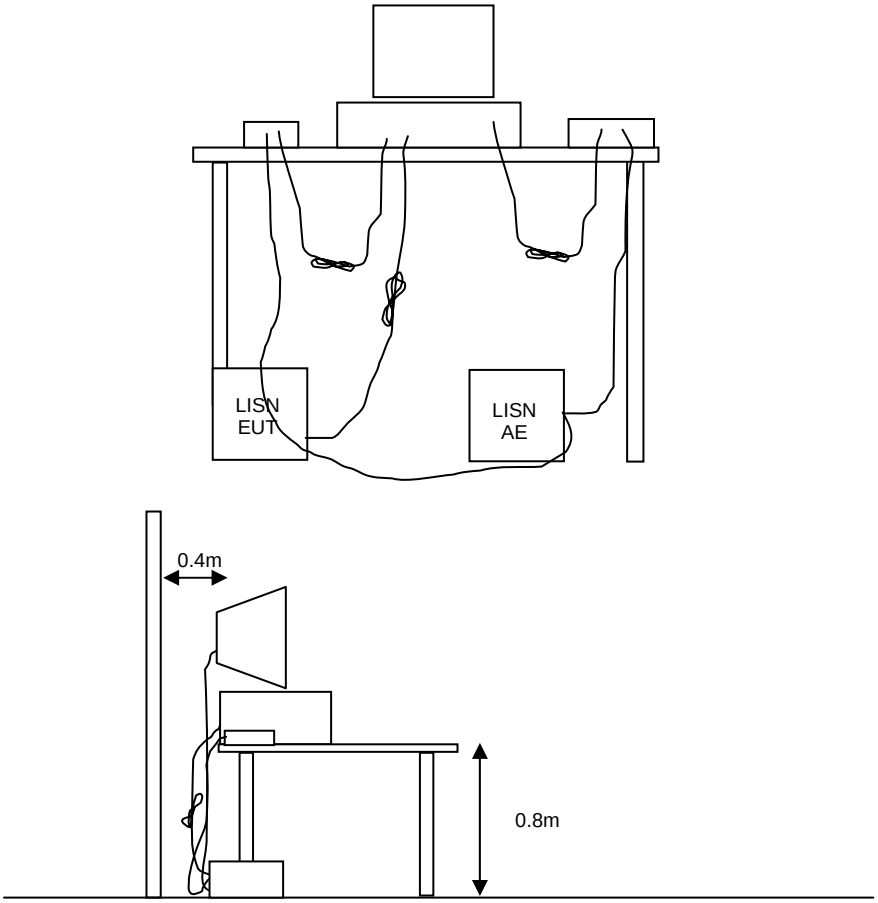


Figure 1 Typical Conducted Emissions Test Configuration

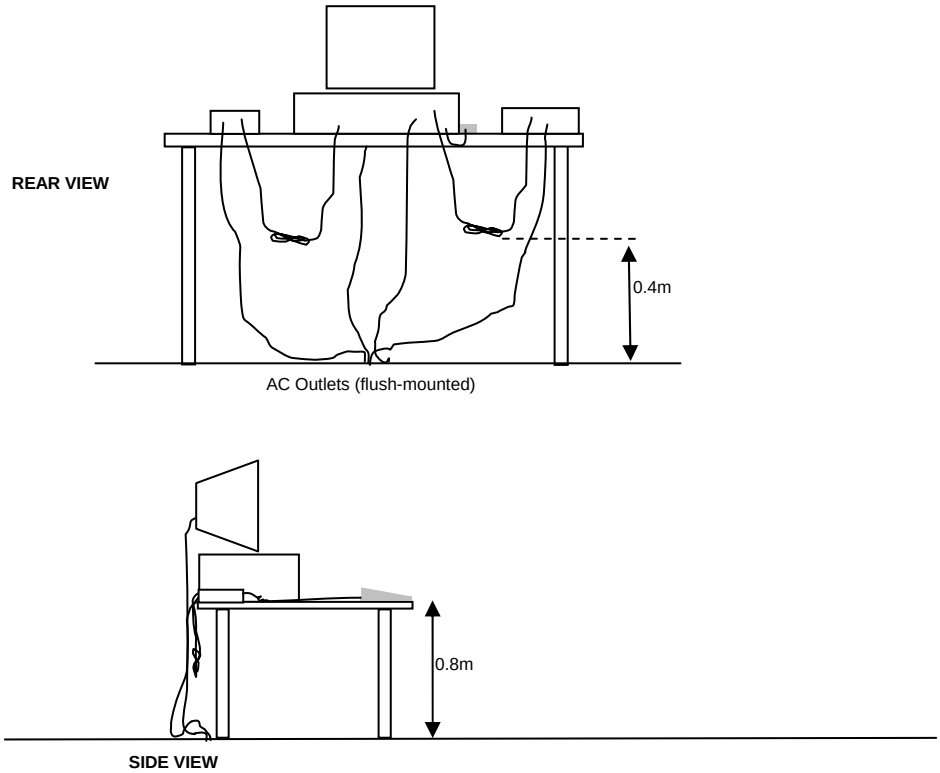
RADIATED EMISSIONS

A preliminary scan of the radiated emissions is performed in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed, one scan for each antenna polarization (horizontal and vertical; loop parallel and perpendicular to the EUT). During the preliminary scans, the EUT is rotated through 360˚, the antenna height is varied (for measurements above 30 MHz) and cable positions are varied to determine the highest emission relative to the limit. Preliminary scans may be performed in a fully anechoic chamber for the purposes of identifying the frequencies of the highest emissions from the EUT.

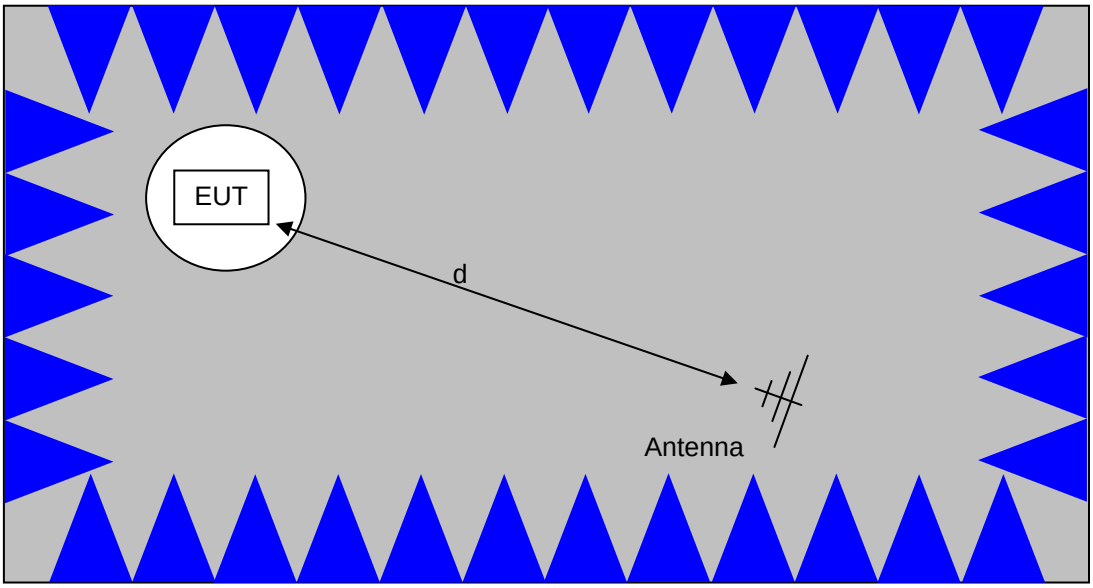
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth, which results in the highest emission is then maintained while varying the antenna height from one to four meters (for measurements above 30 MHz, measurements below 30 MHz are made with the loop antenna at a fixed height of 1m). The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain.

When testing above 18 GHz, the receive antenna is located at 1meter from the EUT and the antenna height is restricted to a maximum of 2.5 meters.

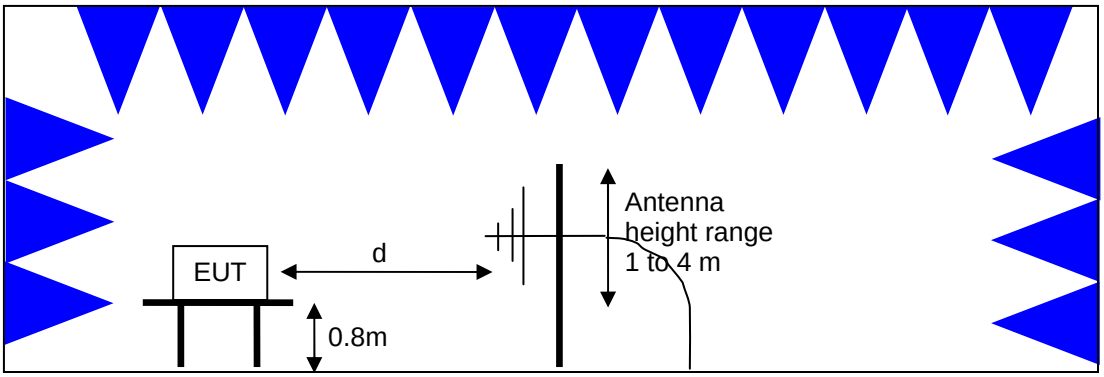


Typical Test Configuration for Radiated Field Strength Measurements



The anechoic materials on the walls and ceiling ensure compliance with the normalized site attenuation requirements of CISPR 16 / CISPR 22 / ANSI C63.4 for an alternate test site at the measurement distances used.

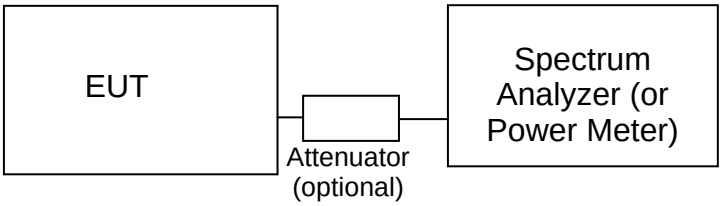
Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



Test Configuration for Radiated Field Strength Measurements
Semi-Anechoic Chamber, Plan and Side Views

CONDUCTED EMISSIONS FROM ANTENNA PORT

Direct measurements of power, bandwidth and power spectral density are performed, where possible, with the antenna port of the EUT connected to either the power meter or spectrum analyzer via a suitable attenuator and/or filter. These are used to ensure that the front end of the measurement instrument is not overloaded by the fundamental transmission.



Test Configuration for Antenna Port Measurements

Measurement bandwidths (video and resolution) are set in accordance with the relevant standards and Elliott's test procedures for the type of radio being tested. When power measurements are made using a resolution bandwidth less than the signal bandwidth the power is calculated by summing the power across the signal bandwidth using either the analyzer channel power function or by capturing the trace data and calculating the power using software. In both cases the summed power is corrected to account for the equivalent noise bandwidth (ENBW) of the resolution bandwidth used.

If power averaging is used (typically for certain digital modulation techniques), the EUT is configured to transmit continuously. Power averaging is performed using either the built-in function of the analyzer or, if the analyzer does not feature power averaging, using external software. In both cases the average power is calculated over a number of sweeps (typically 100). When the EUT cannot be configured to continuously transmit then either the analyzer is configured to perform a gated sweep to ensure that the power is averaged over periods that the device is transmitting or power averaging is disabled and a max-hold feature is used.

If a power meter is used to make output power measurements the sensor head type (peak or average) is stated in the test data table.

BANDWIDTH MEASUREMENTS

The 6dB, 20dB and/or 26dB signal bandwidth is measured in using the bandwidths recommended by ANSI C63.4. When required, the 99% bandwidth is measured using the methods detailed in RSS GEN.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

The limits for conducted emissions are given in units of microvolts, and the limits for radiated emissions are given in units of microvolts per meter at a specified test distance. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

For reference, converting the specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. These limits in both linear and logarithmic form are as follows:

CONDUCTED EMISSIONS SPECIFICATION LIMITS: FCC 15.207; FCC 15.107(a), RSS GEN

The table below shows the limits for the emissions on the AC power line from an intentional radiator and a receiver.

Frequency (MHz)	Average Limit (dBuV)	Quasi Peak Limit (dBuV)
0.150 to 0.500	Linear decrease on logarithmic frequency axis between 56.0 and 46.0	Linear decrease on logarithmic frequency axis between 66.0 and 56.0
0.500 to 5.000	46.0	56.0
5.000 to 30.000	50.0	60.0

GENERAL TRANSMITTER RADIATED EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from transmitters that fall in restricted bands[1] (with the exception of transmitters operating under FCC Part 15 Subpart D and RSS 210 Annex 9), the limits for all emissions from a low power device operating under the general rules of RSS 310 (tables 3 and 4), RSS 210 (table 2) and FCC Part 15 Subpart C section 15.209.

Frequency Range (MHz)	Limit (uV/m)	Limit (dBuV/m @ 3m)
0.009-0.490	$2400/F_{KHz}$ @ 300m	$67.6-20*\log_{10}(F_{KHz})$ @ 300m
0.490-1.705	$24000/F_{KHz}$ @ 30m	$87.6-20*\log_{10}(F_{KHz})$ @ 30m
1.705 to 30	30 @ 30m	29.5 @ 30m
30 to 88	100 @ 3m	40 @ 3m
88 to 216	150 @ 3m	43.5 @ 3m
216 to 960	200 @ 3m	46.0 @ 3m
Above 960	500 @ 3m	54.0 @ 3m

RECEIVER RADIATED SPURIOUS EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from receivers as detailed in FCC Part 15.109, RSS 210 Table 2, RSS GEN Table 1 and RSS 310 Table 3. Note that receivers operating outside of the frequency range 30 MHz – 960 MHz are exempt from the requirements of 15.109.

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
30 to 88	100	40
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

[1] The restricted bands are detailed in FCC 15.203, RSS 210 Table 1 and RSS 310 Table 2

OUTPUT POWER LIMITS – FHSS SYSTEMS

The table below shows the limits for output power based on the number of channels available for the hopping system.

Operating Frequency (MHz)	Number of Channels	Output Power
902 – 928	≥ 50	1 Watt (30 dBm)
902 – 928	25 to 49	0.25 Watts (24 dBm)
2400 – 2483.5	≥ 75	1 Watt (30 dBm)
2400 – 2483.5	< 75	0.125 Watts (21 dBm)
5725 – 5850	75	1 Watt (30 dBm)

The maximum permitted output power is reduced by 1dB for every dB the antenna gain exceeds 6dBi. Fixed point-to-point applications using the 5725 – 5850 MHz band are not subject to this restriction.

TRANSMIT MODE SPURIOUS RADIATED EMISSIONS LIMITS – FHSS and DTS SYSTEMS

The limits for unwanted (spurious) emissions from the transmitter falling in the restricted bands are those specified in the general limits sections of FCC Part 15 and RSS 210. All other unwanted (spurious) emissions shall be at least 20dB below the level of the highest in-band signal level (30dB if the power is measured using the sample detector/power averaging method).

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_r - S = M$$

where:

R_r = Receiver Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

SAMPLE CALCULATIONS - RADIATED EMISSIONS

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

A distance factor, when used for electric field measurements above 30MHz, is calculated by using the following formula:

$$F_d = 20*LOG_{10} (D_m/D_s)$$

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

For electric field measurements below 30MHz the extrapolation factor is either determined by making measurements at multiple distances or a theoretical value is calculated using the formula:

$$F_d = 40*LOG_{10} (D_m/D_s)$$

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_c = Corrected Reading in dBuV/m

L_s = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

SAMPLE CALCULATIONS - FIELD STRENGTH TO EIRP CONVERSION

Where the radiated electric field strength is expressed in terms of the equivalent isotropic radiated power (eirp), or where a field strength measurement of output power is made in lieu of a direct measurement, the following formula is used to convert between eirp and field strength at a distance of d (meters) from the equipment under test:

$$E = \frac{1000000 \sqrt{30 P}}{d} \quad \text{microvolts per meter}$$

where P is the eirp (Watts)

For a measurement at 3m the conversion from a logarithmic value for field strength (dBuV/m) to an eirp power (dBm) is -95.3dB.

Appendix A Test Equipment Calibration Data

Radiated Emissions, 1,000 - 18,000 MHz, 16-May-11

Manufacturer	Description	Model	Asset #	Cal Due
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	263	12/8/2011
EMCO	Antenna, Horn, 1-18GHz	3115	868	6/8/2012
Hewlett Packard	SpecAn 30 Hz -40 GHz, SV (SA40) Red	8564E (84125C)	1148	7/12/2011
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	2238	10/1/2011

Radio Antenna Port (Power and Spurious Emissions), 18-May-11

Manufacturer	Description	Model	Asset #	Cal Due
Rohde & Schwarz	Power Meter, Dual Channel	NRVD	1071	6/1/2011
Hewlett Packard	SpecAn 9 kHz - 40 GHz, FT (SA40) Blue	8564E (84125C)	1393	6/14/2011
Rohde & Schwarz	Power Sensor 100 uW - 2 Watts (w/ 20 dB pad, SN BJ5155)	NRV-Z32	1536	9/13/2011

Radiated Spurious Emissions, 1000 - 25,000 MHz, 18-May-11

Manufacturer	Description	Model	Asset #	Cal Due
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	5/18/2012
EMCO	Antenna, Horn, 1-18 GHz (SA40-Blu)	3115	1386	9/21/2012
Hewlett Packard	SpecAn 9 kHz - 40 GHz, FT (SA40) Blue	8564E (84125C)	1393	6/14/2011
Micro-Tronics	Band Reject Filter, 5725-5875 MHz	BRC50705-02	1682	3/23/2012

Conducted Emissions - AC Power Ports, 16-Dec-11

Manufacturer	Description	Model	Asset #	Cal Due
EMCO	LISN, 10 kHz-100 MHz, 25A	3825/2	1292	3/1/2012
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1756	4/6/2012

Appendix B Test Data

T83197 Pages 25 – 53
T83198 Pages 54 - 62

Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		-
Emissions Standard(s):	FCC 15.247/RSS-210	Class:	-
Immunity Standard(s):	EN 301 489-1 V1.8.1	Environment:	-

EMC Test Data

For The

Summit Data Communications

Model

SDC-MSD40NBT (1x1 802.11abg + BT 2.1)

Date of Last Test:

Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	FCC 15.247/RSS-210	Class:	N/A

RSS 210 and FCC 15.247 (DTS) Radiated Spurious Emissions (Bluetooth)

Summary of Results - Device Operating in the 2400-2483.5 MHz Band

Bluetooth uses a frequency hopping algorithm that means that the device, during normal operation, is only on a specific channel for a short period of time. The average correction factor is calculated as follows:

A maximum length packet has a duration of 5 time slots.

The hopping rate is 1600 hops/second so the maximum dwell time is 5/1600 seconds, or 3.125ms.

With a minimum of 20 hopping channels a channel will not be used more than 4 times in any 100ms period.

The maximum dwell time in a 100m period is 4 x 3.125ms = 12.5ms.

The average correction factor is, therefore, 20log(12.5/100) =-18dB

As this is a hopping radio the correction factor can be applied to the average value of the signal provided the average value was measured with the device continuously transmitting. DA 00-0705 permits the use of the average correction on the measured average value for frequency hopping radios.

Run #	Mode	Channel	Antenna	Power Setting	Test Performed	Limit	Result / Margin
Run # 1	Basic (1 Mb/s) Chain A	2402MHz	Cisco	Default	Restricted Band Edge at 2390 MHz	15.209	47.3dBµV/m @ 2353.3MHz (-6.7dB)
		2480MHz	Cisco	Default	Restricted Band Edge at 2483.5 MHz	15.209	49.1dBµV/m @ 2483.5MHz (-4.9dB)
Run # 2	EDR (3 Mb/s) Chain A	2402MHz	Cisco	Default	Restricted Band Edge at 2390 MHz	15.209	47.2dBµV/m @ 2379.3MHz (-6.8dB)
		2480MHz	Cisco	Default	Restricted Band Edge at 2483.5 MHz	15.209	50.5dBµV/m @ 2483.5MHz (-3.5dB)

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

Ambient Conditions:

Temperature: 20-25 °C

Rel. Humidity: 40-50 %

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

EMC Test Data

Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	FCC 15.247/RSS-210	Class:	N/A

Run # 1, Band Edge Field Strength - Basic (1 Mb/s), Chain A

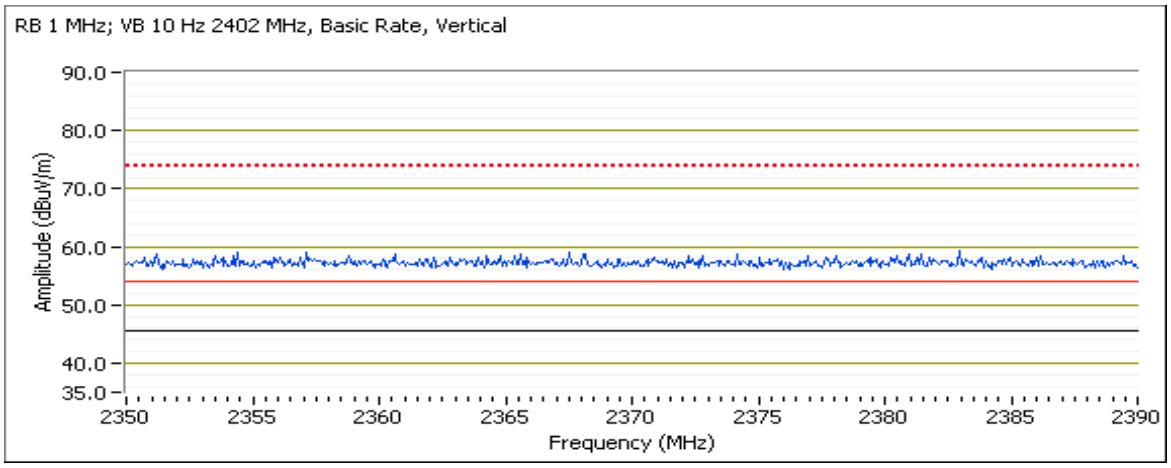
Date of Test: 5/16/2011 Test Location: FT#7

Test Engineer: Mark Hill Config Change: none

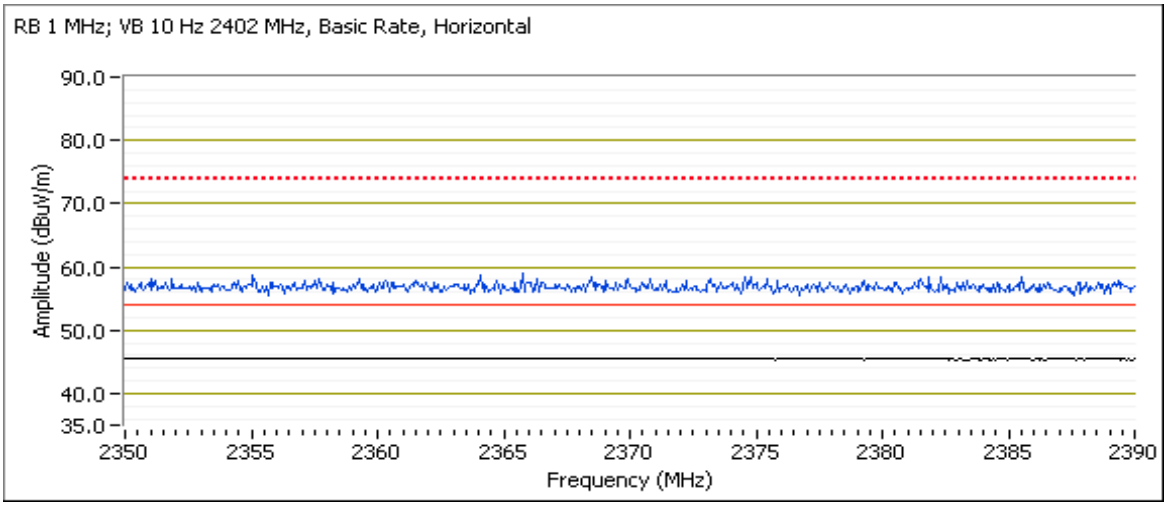
Run # 1a, EUT on Channel 2402MHz - Basic (1 Mb/s), Chain A

2390 MHz Band Edge Signal Field Strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2353.270	47.3	H	54.0	-6.7	AVG	248	1.0	RB 1 MHz;VB 10 Hz;Pk
2357.400	47.1	V	54.0	-6.9	AVG	237	1.0	RB 1 MHz;VB 10 Hz;Pk
2387.730	59.2	V	74.0	-14.8	PK	237	1.0	RB 1 MHz;VB 3 MHz;Pk
2357.800	58.4	H	74.0	-15.6	PK	248	1.0	RB 1 MHz;VB 3 MHz;Pk



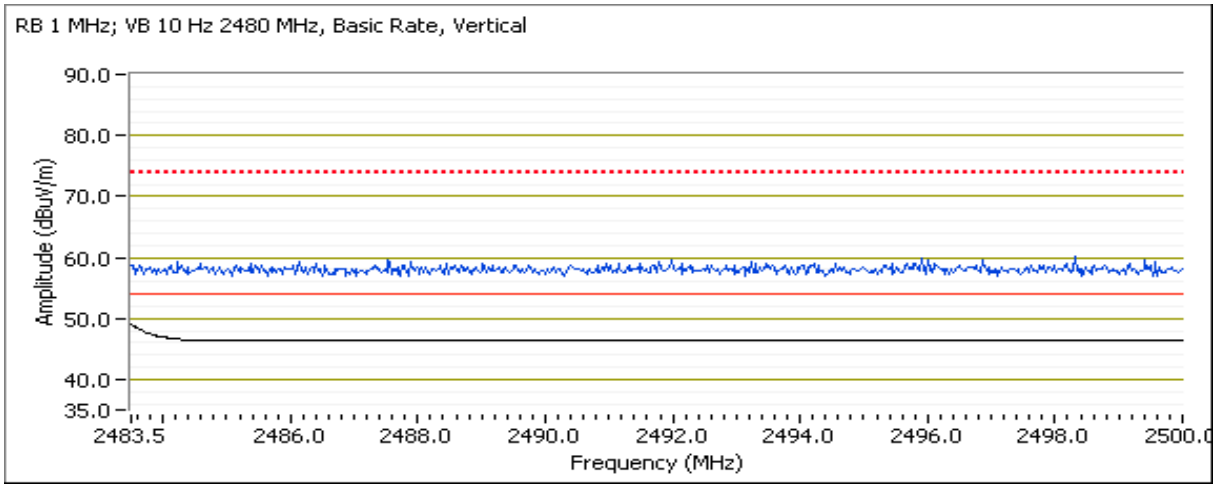
Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	FCC 15.247/RSS-210	Class:	N/A



Run # 1b, EUT on Channel 2480MHz - Basic (1 Mb/s), Chain A

2483.5 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2483.500	49.1	V	54.0	-4.9	AVG	234	1.0	RB 1 MHz;VB 10 Hz;Pk
2491.280	59.8	V	74.0	-14.2	PK	234	1.0	RB 1 MHz;VB 3 MHz;Pk



Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	FCC 15.247/RSS-210	Class:	N/A

Run # 2, Band Edge Field Strength - EDR (3 Mb/s), Chain A

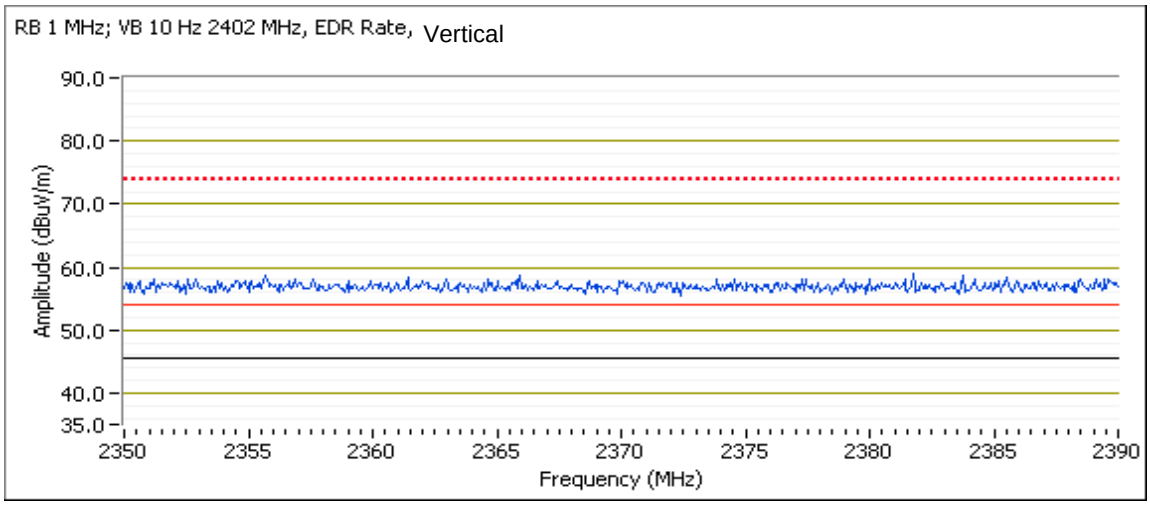
Date of Test: 5/16/2011 Test Location: FT#7

Test Engineer: Mark Hill Config Change: none

Run # 2a, EUT on Channel 2402MHz - EDR (3 Mb/s), Chain A

2390 MHz Band Edge Signal Field Strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2379.270	47.2	V	54.0	-6.8	AVG	237	1.0	RB 1 MHz;VB 10 Hz;Pk
2360.130	58.6	V	74.0	-15.4	PK	237	1.0	RB 1 MHz;VB 3 MHz;Pk

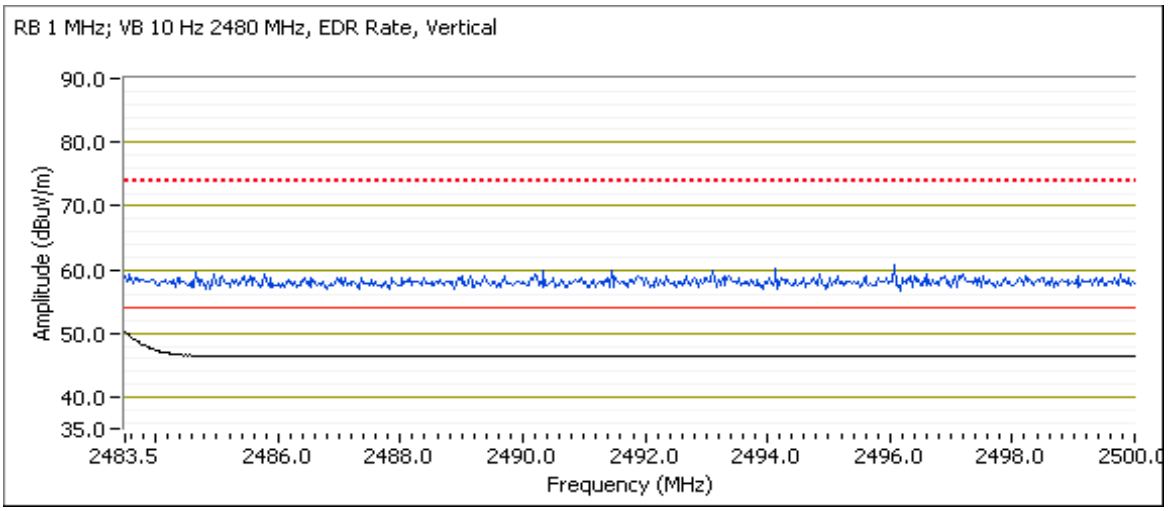


Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	FCC 15.247/RSS-210	Class:	N/A

Run # 2b, EUT on Channel 2480MHz - EDR (3 Mb/s), Chain A

2483.5 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2483.500	50.5	V	54.0	-3.5	AVG	233	1.0	RB 1 MHz;VB 10 Hz;Pk
2488.090	59.9	V	74.0	-14.1	PK	233	1.0	RB 1 MHz;VB 3 MHz;Pk



Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	FCC 15.247/RSS-210	Class:	N/A

RSS 210 and FCC 15.247 (DTS) Radiated Spurious Emissions (Bluetooth)

Summary of Results - Device Operating in the 2400-2483.5 MHz Band

For Bluetooth: Tx is chain B, Rx is chain B

Bluetooth uses a frequency hopping algorithm that means that the device, during normal operation, is only on a specific channel for a short period of time. The average correction factor is calculated as follows:

A maximum length packet has a duration of 5 time slots.

The hopping rate is 1600 hops/second so the maximum dwell time is 5/1600 seconds, or 3.125ms.

With a minimum of 20 hopping channels a channel will not be used more than 4 times in any 100ms period.

The maximum dwell time in a 100m period is 4 x 3.125ms = 12.5ms.

The average correction factor is, therefore, 20log(12.5/100) =-18dB

As this is a hopping radio the correction factor can be applied to the average value of the signal provided the average value was measured with the device continuously transmitting. DA 00-0705 permits the use of the average correction on the measured average value for frequency hopping radios.

Run #	Mode	Channel	Antenna	Power Setting	Test Performed	Limit	Result / Margin
Run #1	Basic (1 Mb/s) Chain A	2402MHz	Cisco	Default	Radiated Emissions, 1 - 26 GHz	FCC 15.209 / 15.247	46.7dBµV/m @ 2994.6MHz (-7.3dB)
		2440MHz	Cisco	Default			46.9 dBµV/m @ 3223.5 MHz (-7.1 dB)
		2480MHz	Cisco	Default			47.5dBµV/m @ 1653.4MHz (-6.5dB)
Run # 2	EDR (3 Mb/s) Chain A	2402MHz	Cisco	Default	Radiated Emissions, 1 - 26 GHz	FCC 15.209 / 15.247	46.2dBµV/m @ 2994.5MHz (-7.8dB)
		2440MHz	Cisco	Default			47.0dBµV/m @ 2994.4MHz (-7.0dB)
		2480MHz	Cisco	Default			46.6dBµV/m @ 1653.2MHz (-7.4dB)
3	Bluetooth Receive	2440	Cisco	-	Radiated Emissions, 1 - 7.5 GHz	RSS 210	45.5dBµV/m @ 2994.6MHz (-8.5dB)

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

Ambient Conditions:

Temperature: 20-25 °C

Rel. Humidity: 40-50 %

Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	FCC 15.247/RSS-210	Class:	N/A

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Run #1, Radiated Spurious Emissions, 1-26GHz, Basic (1 Mb/s), Chain A

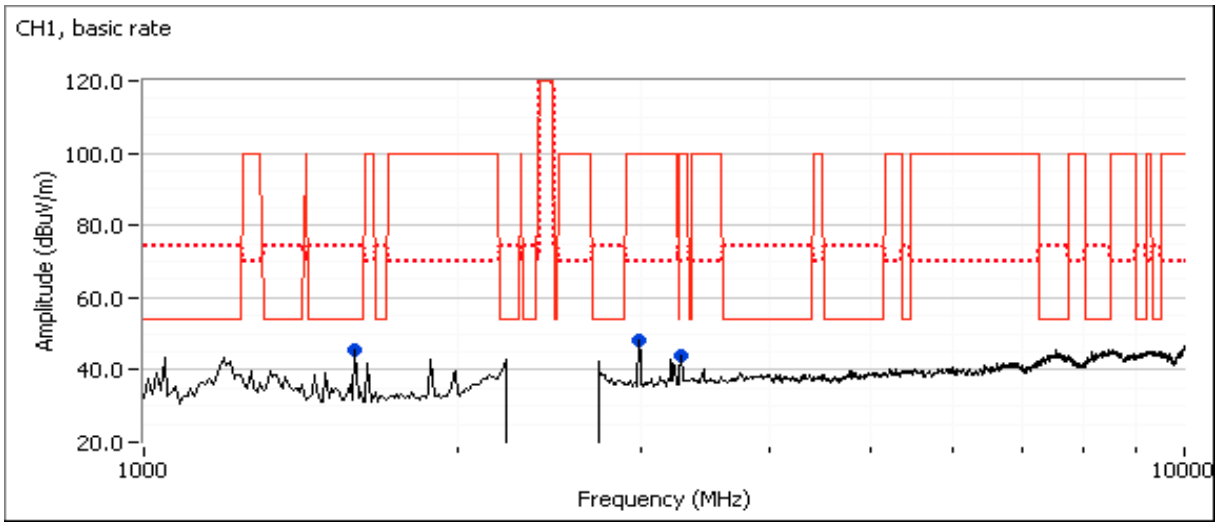
Date of Test: 5/16/2011& 5/18/11 Test Location: FT #7

Test Engineer: Mark Hill / John Caizzi Config Change: -

Run #1a, EUT on Channel 2402MHz - Basic (1 Mb/s), Chain A

Frequency	Level	Pol	15.209/15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2994.640	46.7	V	54.0	-7.3	Pk	124	1.00	RB 100 kHz;VB 100 kHz, Note 2
1601.330	46.2	H	54.0	-7.8	AVG	212	1.27	
1601.400	47.6	H	74.0	-26.4	PK	212	1.27	
2994.640	45.9	V	54.0	-8.1	AVG	124	1.00	Note 2
2994.670	50.4	V	74.0	-23.6	PK	124	1.00	Note 2

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit is -30dBc for peak measurements in a measurement bandwidth of 100kHz.
Note 2:	Emission not in restricted band but restricted band limit used.



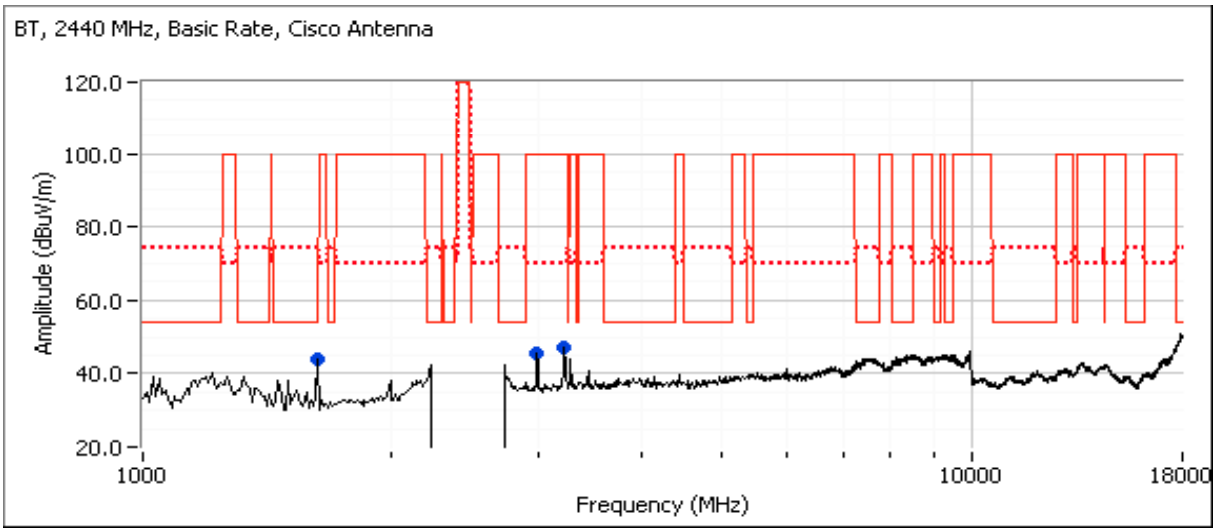
Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	FCC 15.247/RSS-210	Class:	N/A

Run #1b: , EUT on Channel 2440MHz - Basic (1 Mb/s), Chain A

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209/15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
3223.470	46.9	H	54.0	-7.1	Peak	233	1.0	Note 4
2994.390	45.4	V	54.0	-8.6	Peak	128	1.0	Note 4
1626.500	42.3	H	54.0	-11.7	AVG	87	1.0	RB 1 MHz;VB 10 Hz;Pk
1626.460	45.1	H	74.0	-28.9	PK	87	1.0	RB 1 MHz;VB 3 MHz;Pk

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit is -30dBc for peak measurements in a measurement bandwidth of 100kHz.
Note 2:	Scans made between 18 - 26GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no signifcant emissions in this frequency range
Note 4:	Emission not in restricted band but restricted band limit used.



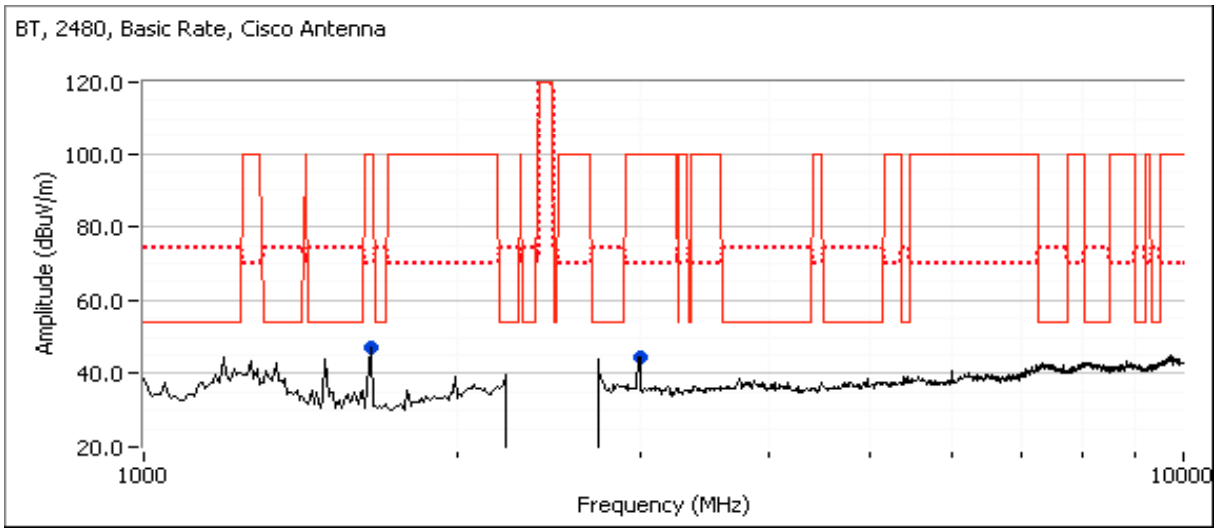
Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	FCC 15.247/RSS-210	Class:	N/A

Run #1c: , EUT on Channel 2480MHz - Basic (1 Mb/s), Chain A

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209/15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1653.350	47.5	V	54.0	-6.5	PK	191	1.0	Note 2
1653.390	47.0	V	54.0	-7.0	AVG	191	1.0	RB 1 MHz;VB 10 Hz;Pk, note 2
1653.330	49.2	V	74.0	-24.8	PK	191	1.0	RB 1 MHz;VB 3 MHz;Pk, note 2
2994.710	42.4	V	54.0	-11.6	AVG	348	1.0	RB 1 MHz;VB 10 Hz;Pk, note 2
2994.730	49.7	V	74.0	-24.3	PK	348	1.0	RB 1 MHz;VB 3 MHz;Pk, note 2
2994.640	43.8	V	54.0	-10.2	PK	348	1.0	Note 2

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit is -30dBc for peak measurements in a measurement bandwidth of 100kHz.
Note 2:	Emission not in restricted band but restricted band limit used.



Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	FCC 15.247/RSS-210	Class:	N/A

Run # 2, Radiated Spurious Emissions, 1-26GHz, EDR (3 Mb/s), Chain A

Date of Test: 5/18/2011 Test Location: FT Chamber #7

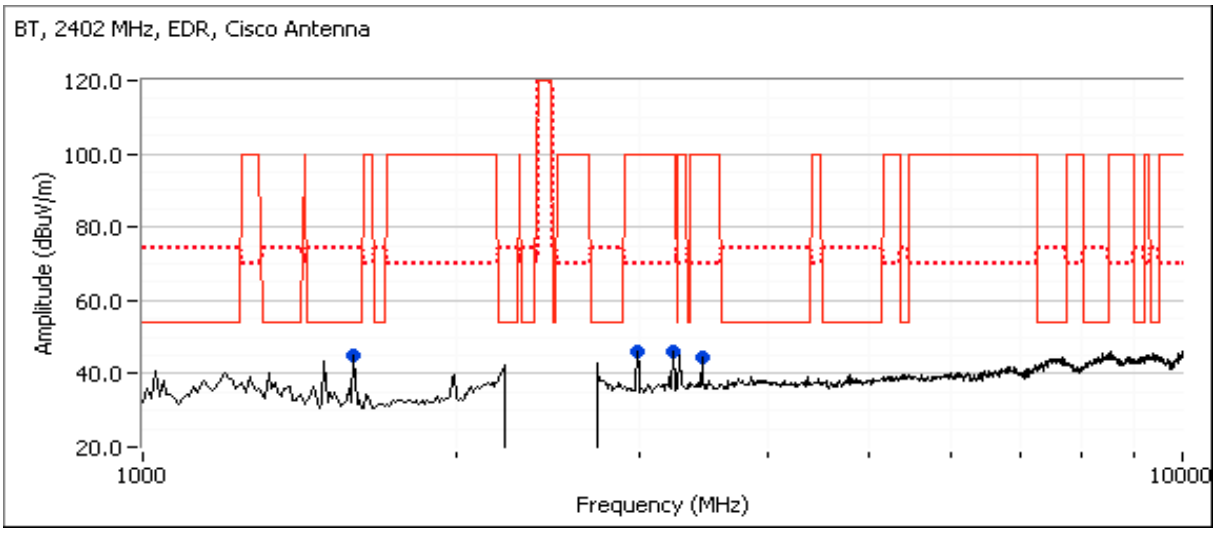
Test Engineer: Rafael Varelas Config Change: None

Run # 2a, EUT on Channel 2402MHz - EDR (3 Mb/s), Chain A

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209/15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2994.480	46.2	V	54.0	-7.8	Peak	119	1.0	Note 3
1601.330	44.5	V	54.0	-9.5	AVG	165	1.0	RB 1 MHz;VB 10 Hz;Pk
1601.280	47.0	V	74.0	-27.0	PK	165	1.0	RB 1 MHz;VB 3 MHz;Pk
3231.360	45.9	H	54.0	-8.1	Peak	212	1.0	Note 3
3456.290	44.6	V	54.0	-9.4	Peak	157	1.0	Note 3

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit is -30dBc for peak measurements in a measurement bandwidth of 100kHz.
Note 3:	Emission not in restricted band but restricted band limit used.



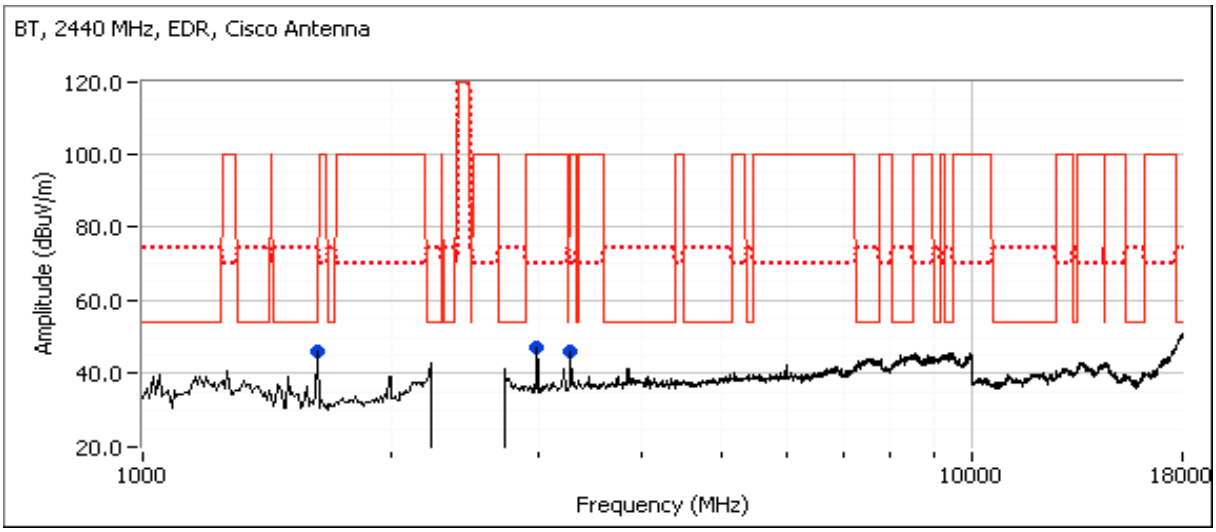
Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	FCC 15.247/RSS-210	Class:	N/A

Run # 2b: , EUT on Channel 2440MHz - EDR (3 Mb/s), Chain A

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209/15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2994.390	47.0	V	54.0	-7.0	Peak	118	1.0	Note 4
1626.500	44.9	V	54.0	-9.1	AVG	165	1.1	RB 1 MHz;VB 10 Hz;Pk
1626.450	46.9	V	74.0	-27.1	PK	165	1.1	RB 1 MHz;VB 3 MHz;Pk
3292.570	46.2	H	54.0	-7.8	Peak	238	1.0	Note 4

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit is -30dBc for peak measurements in a measurement bandwidth of 100kHz.
Note 2:	Scans made between 18 - 26GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no signifcant emissions in this frequency range
Note 4:	Emission not in restricted band but restricted band limit used.



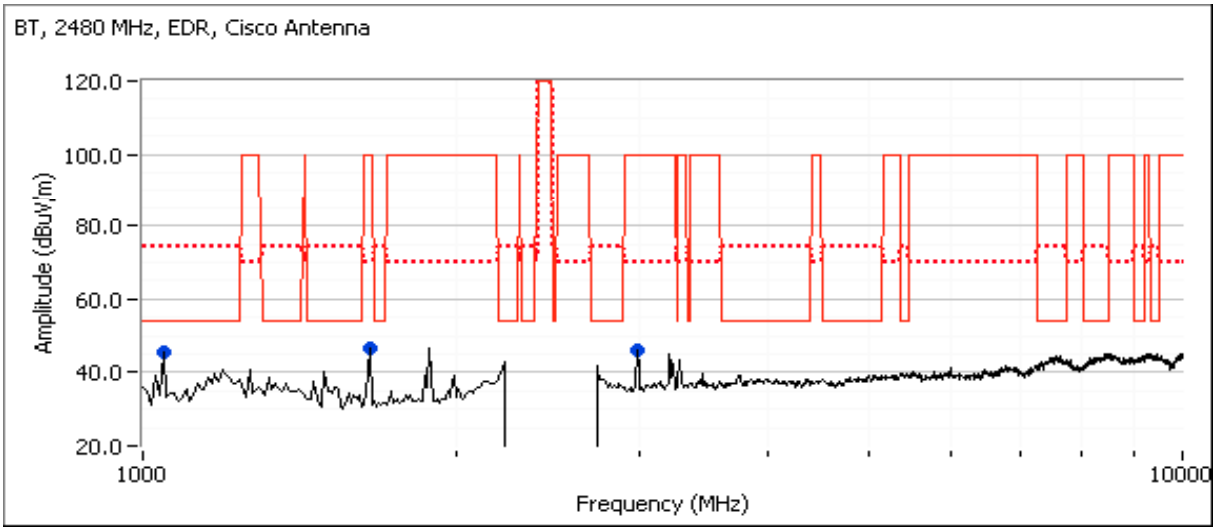
Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	FCC 15.247/RSS-210	Class:	N/A

Run # 2c: , EUT on Channel 2480MHz - EDR (3 Mb/s), Chain A

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209/15.247		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1653.210	46.6	V	54.0	-7.4	Peak	148	1.0	Note 3
2994.480	46.0	V	54.0	-8.0	Peak	120	1.0	Note 3
1048.240	31.9	V	54.0	-22.1	AVG	152	1.0	RB 1 MHz;VB 10 Hz;Pk
1048.540	49.0	V	74.0	-25.0	PK	152	1.0	RB 1 MHz;VB 3 MHz;Pk

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit is -30dBc for peak measurements in a measurement bandwidth of 100kHz.
Note 3:	Emission not in restricted band but restricted band limit used.



EMC Test Data

Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	FCC 15.247/RSS-210	Class:	N/A

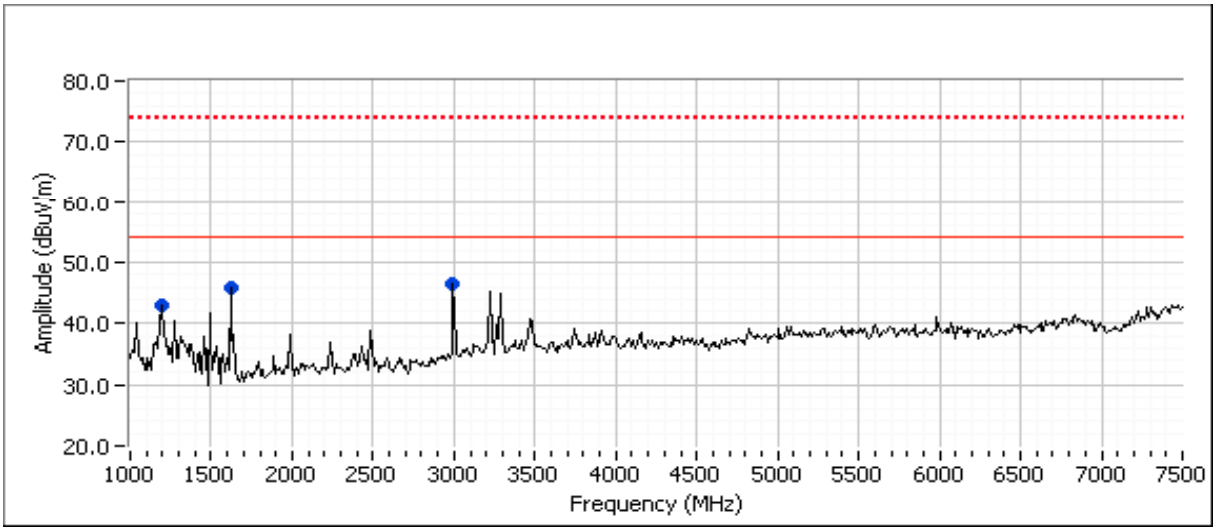
Run # 3, Radiated Spurious Emissions, 1-7.5GHz, Receive, Chain A

Date of Test: 5/18/2011 Test Location: FT Chamber #7

Test Engineer: Rafael Varelas Config Change: None

Run # 3a, EUT on Channel #6 2437MHz - Receive, Chain A

Frequency	Level	Pol	RSS 210		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2994.640	45.5	V	54.0	-8.5	AVG	112	1.0	RB 1 MHz;VB 10 Hz;Pk
2994.590	50.0	V	74.0	-24.0	PK	112	1.0	RB 1 MHz;VB 3 MHz;Pk
1197.670	36.6	V	54.0	-17.4	AVG	95	1.0	RB 1 MHz;VB 10 Hz;Pk
1197.320	56.8	V	74.0	-17.2	PK	95	1.0	RB 1 MHz;VB 3 MHz;Pk
1627.990	43.8	V	54.0	-10.2	AVG	175	1.0	RB 1 MHz;VB 10 Hz;Pk
1628.020	46.0	V	74.0	-28.0	PK	175	1.0	RB 1 MHz;VB 3 MHz;Pk



Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	FCC 15.247/RSS-210	Class:	N/A

FCC 15.247 FHSS - Power, Bandwidth and Spurious Emissions

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 5/18/2011 0:00
Test Engineer: John Caizzi
Test Location: FT7

Config. Used: -
Config Change: -
EUT Voltage: 120V / 60Hz

General Test Configuration

When measuring the conducted emissions from the EUT's antenna port, the antenna port of the EUT was connected to the spectrum analyzer or power meter via a suitable attenuator to prevent overloading the measurement system. All measurements are corrected to allow for the external attenuators used.

Unless stated otherwise the EUT was operating such that it constantly hopped on either the low, center or high channels.

Ambient Conditions:

Temperature: 22 °C
Rel. Humidity: 35 %

Summary of Results

Run #	Test Performed	Limit	Pass / Fail	Result / Margin
1d	30 - 25,000 MHz - Conducted Spurious Emissions	FCC Part 15.247(c)	Pass	All emissions > -20dBc
2	Output Power	15.247(b)	Pass	0.1dBm (1mW) (1.6mW EIRP)
3	20dB Bandwidth	15.247(a)	Pass	1100 kHz
3	99% bandwidth	15.247(a)	Pass	973 kHz
3	Number of Channels	15.247(a)	Pass	Device complies with the Bluetooth 2 specifications with a minimum of 20 hopping channels
4	Channel Occupancy	15.247(a)	Pass	

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	FCC 15.247/RSS-210	Class:	N/A

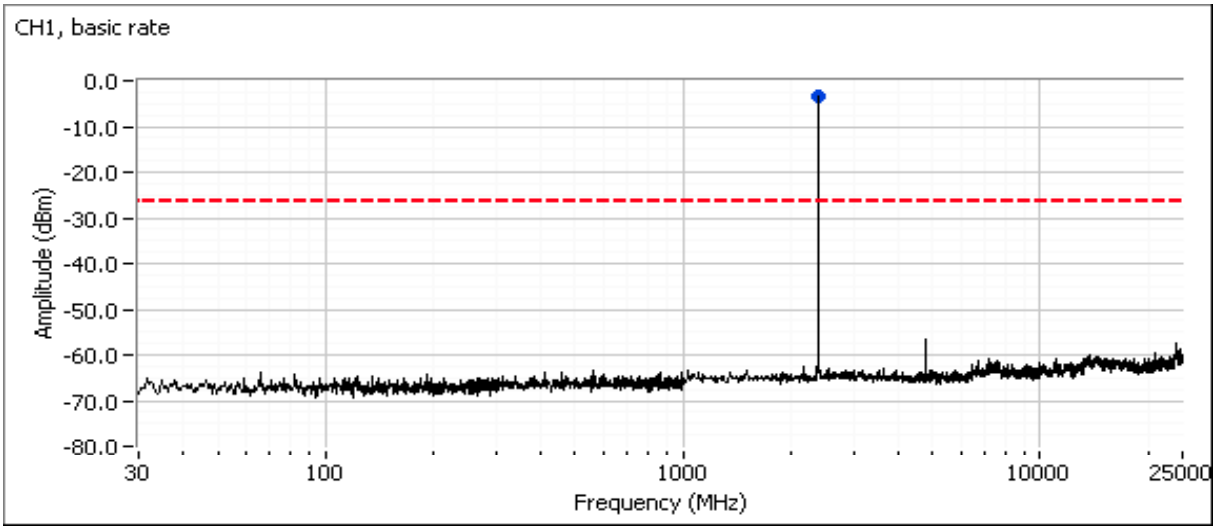
Run #1d: Antenna Conducted Spurious Emissions, 30 - 25,000 MHz.

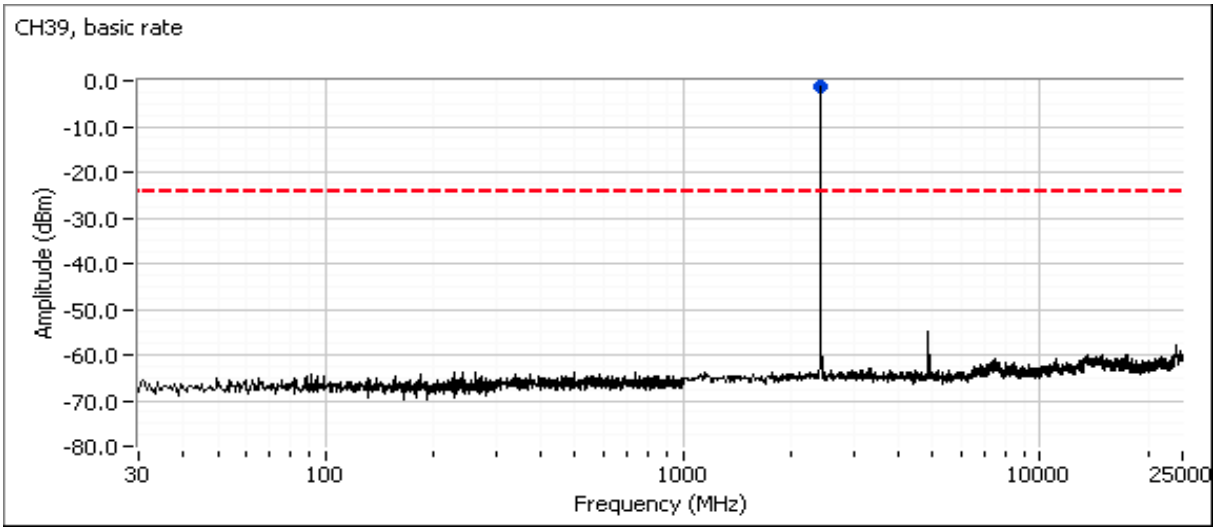
Date of Test: 5/18/2011

Test Engineer: John Caizzi

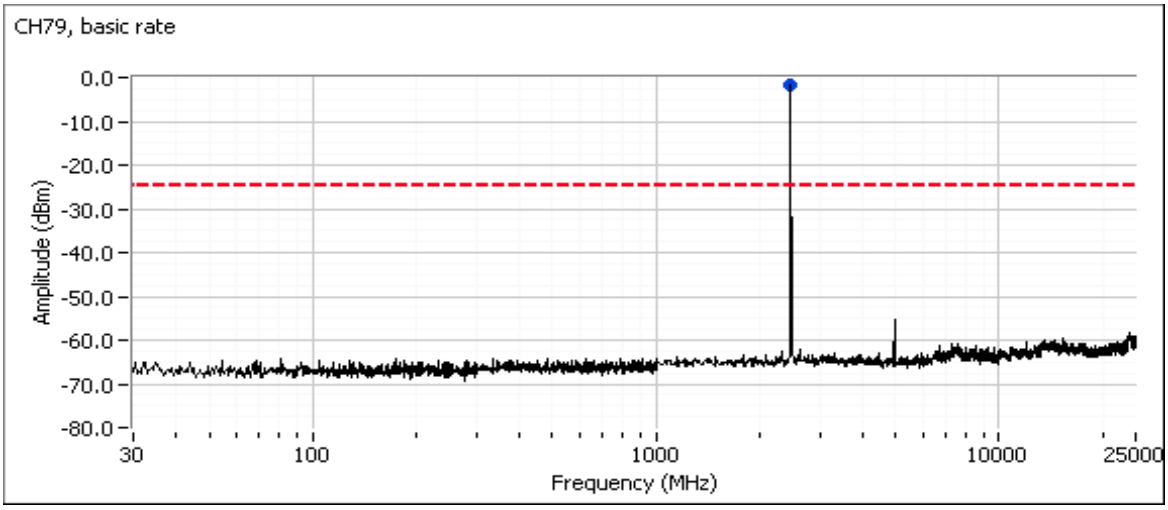
Test Location: FT7

Refer to plots below. Scans made using RBW=VB=100 KHz with the limit line set at 20dB below the highest in-band signal level.





Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	FCC 15.247/RSS-210	Class:	N/A



Run #2: Output Power

Date of Test: 5/18/2011

Test Engineer: John Caizzi

Test Location: FT7

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

Maximum antenna gain: 2 dBi

Channel	Frequency (MHz)	Res BW	Output Power (dBm)	Output Power (W)	EIRP (W)
Low	2402	NA	-1.8	0.0007	0.0010
Mid	2440	NA	-0.5	0.0009	0.0014
High	2480	NA	0.1	0.0010	0.0016

Note 1:	Output power measured with a peak power meter.

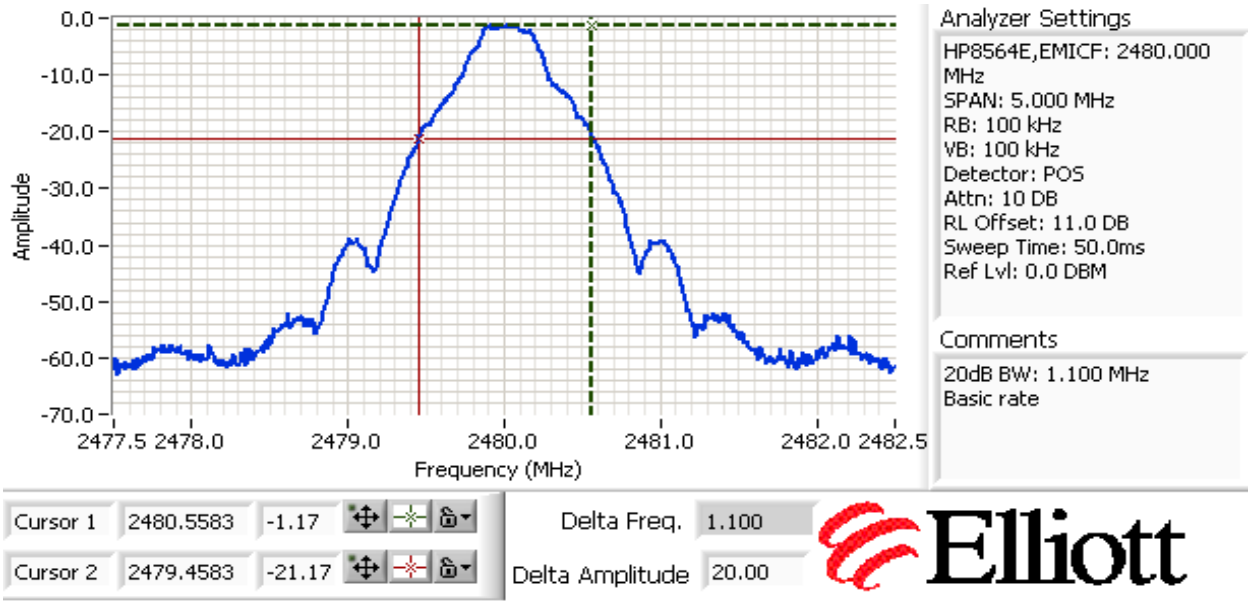
Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	FCC 15.247/RSS-210	Class:	N/A

Run #3: Bandwidth

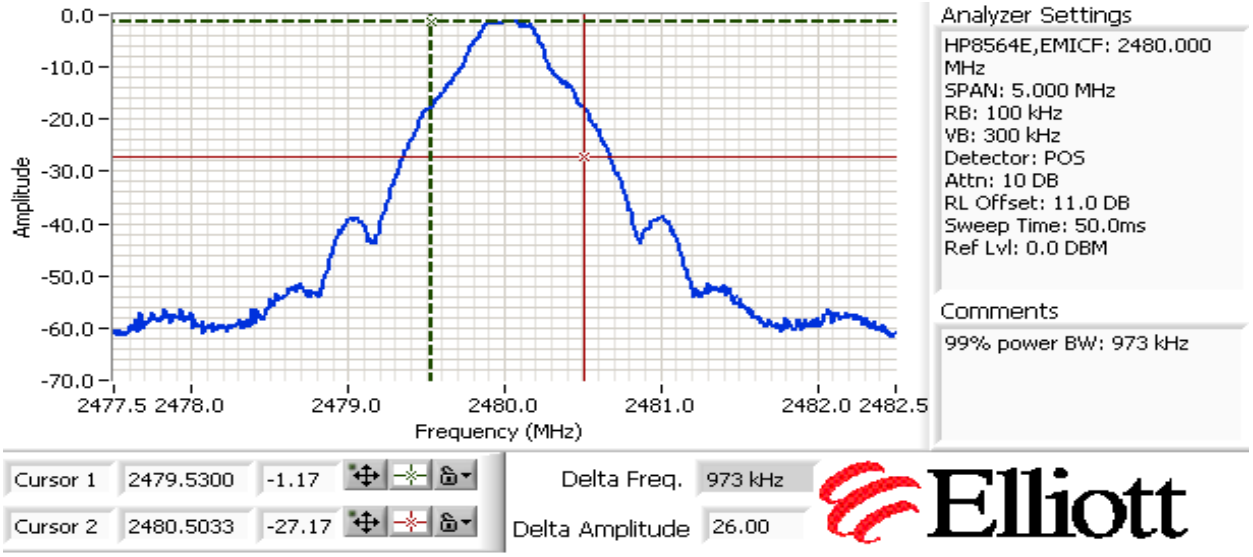
Date of Test: 5/18/2011
Test Engineer: John Caizzi
Test Location: FT7

Channel	Frequency (MHz)	Resolution Bandwidth	20dB Bandwidth (kHz)	Resolution Bandwidth	99% Bandwidth (kHz)
Low	2402	100 kHz	1092	100 kHz	973
Mid	2440	100 kHz	1092	100 kHz	973
High	2480	100 kHz	1100	100 kHz	973

Note 1:	20dB bandwidth measured using RB = 100 kHz, VB = 100 kHz (VB > RB)
Note 2:	99% bandwidth measured using RB = 100 kHz, VB = 300 kHz (VB >=3RB)



Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	FCC 15.247/RSS-210	Class:	N/A



Run #4: Channel Spacing and Number of Channels

Basic Mode

Channel Spacing: 1000 kHz

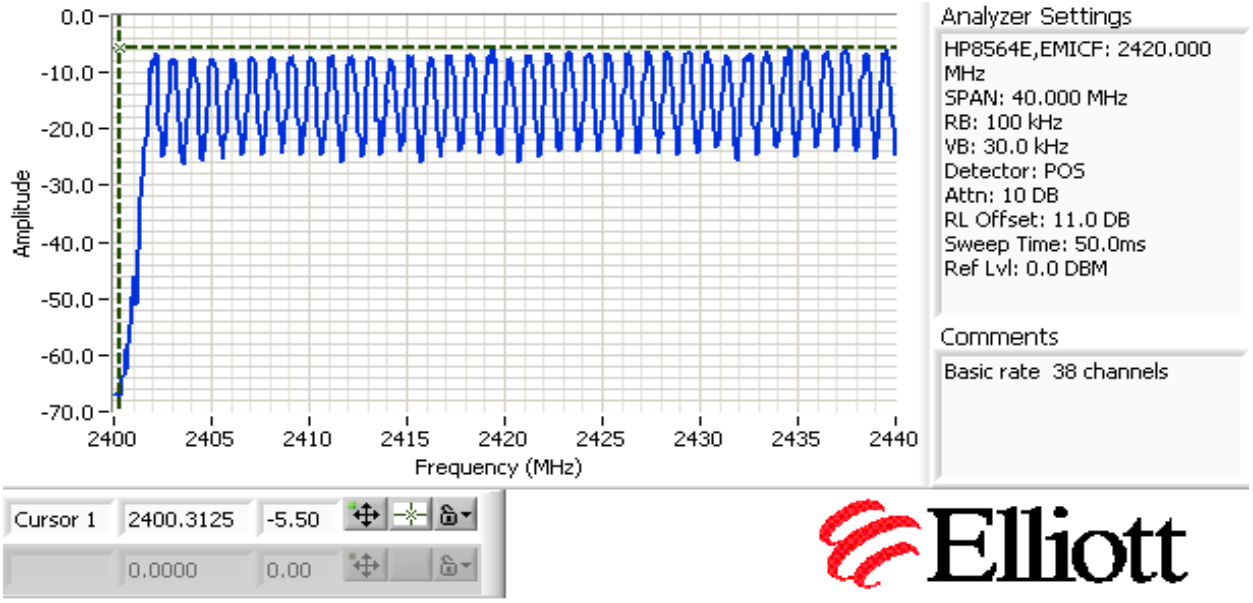
20dB Bandwidth: 1100 kHz

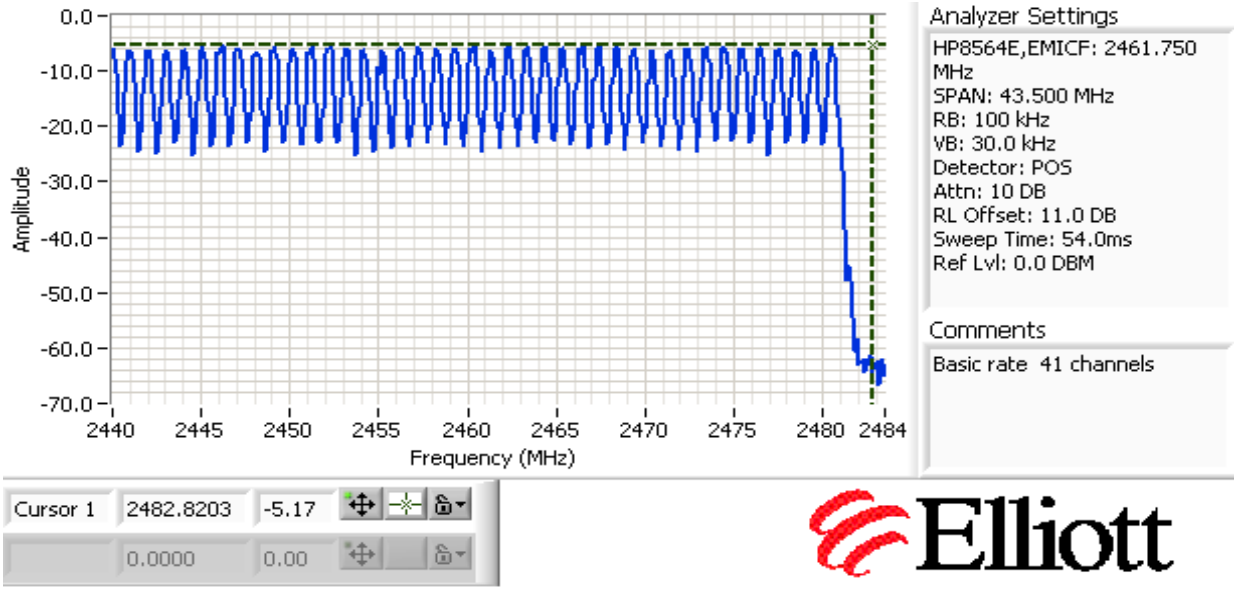
The channel spacing was measured in Basic rate mode with hopping enabled - see plot below showing channel spacing:
The channel spacing shall be greater than 2/3 times the widest 20dB bandwidth, as the ouput power is <0.125W.

Number of channels: 79 Max 20 Min (AFH enabled)

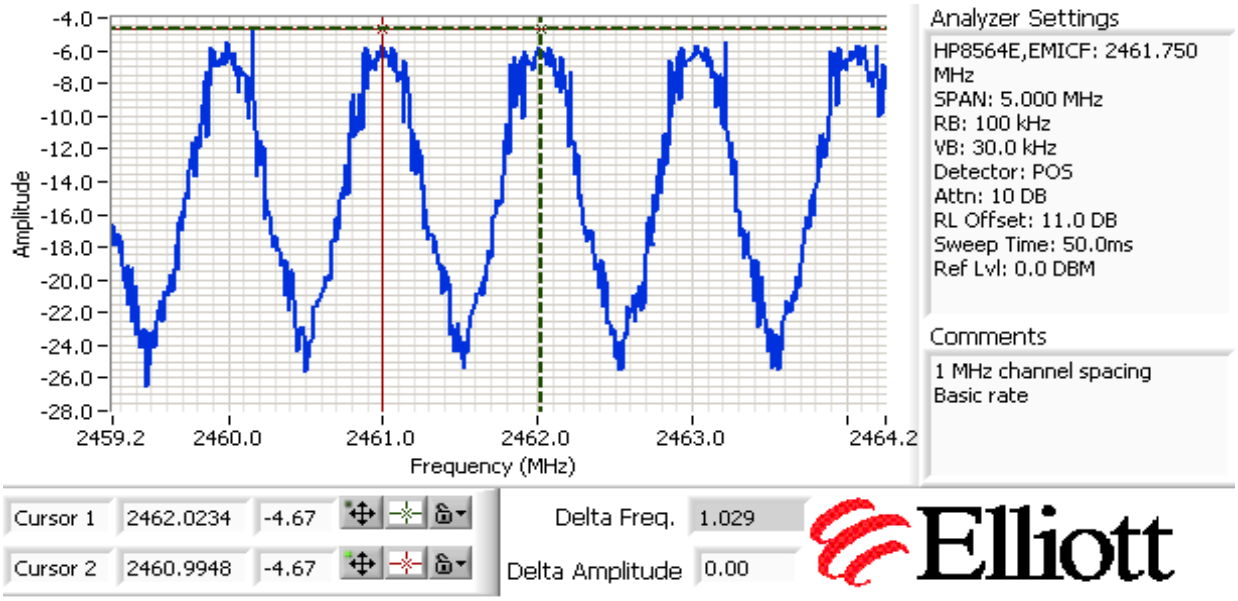
The number of channels was measured in Basic rate mode with hopping enabled with both the maximum (all) channels enabled and with the minimum number of channels enabled. The system shall employ a minimum of 15 hopping channels.

Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	FCC 15.247/RSS-210	Class:	N/A





Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	FCC 15.247/RSS-210	Class:	N/A



Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	FCC 15.247/RSS-210	Class:	N/A

FCC 15.247 FHSS - Power, Bandwidth and Spurious Emissions

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 5/4/2011 14:39
Test Engineer: Mark Hill
Test Location: FT7

Config. Used: -
Config Change: -
EUT Voltage: 120V / 60Hz

General Test Configuration

When measuring the conducted emissions from the EUT's antenna port, the antenna port of the EUT was connected to the spectrum analyzer or power meter via a suitable attenuator to prevent overloading the measurement system. All measurements are corrected to allow for the external attenuators used.

Unless stated otherwise the EUT was operating such that it constantly hopped on either the low, center or high channels.

Ambient Conditions:

Temperature: 22 °C
Rel. Humidity: 35 %

Summary of Results

Run #	Test Performed	Limit	Pass / Fail	Result / Margin
1d	30 - 25,000 MHz - Conducted Spurious Emissions	FCC Part 15.247(c)	Pass	All emissions > -20 dBc
2	Output Power	15.247(b)	Pass	2.2dBm (1.7mW) (2.6mW EIRP)
3	20dB Bandwidth	15.247(a)	Pass	1400 kHz
3	99% bandwidth	15.247(a)	Pass	1265 kHz
3	Number of Channels	15.247(a)	Pass	Device complies with the Bluetooth 2 specifications with a minimum of 20 hopping channels
4	Channel Occupancy	15.247(a)	Pass	

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	FCC 15.247/RSS-210	Class:	N/A

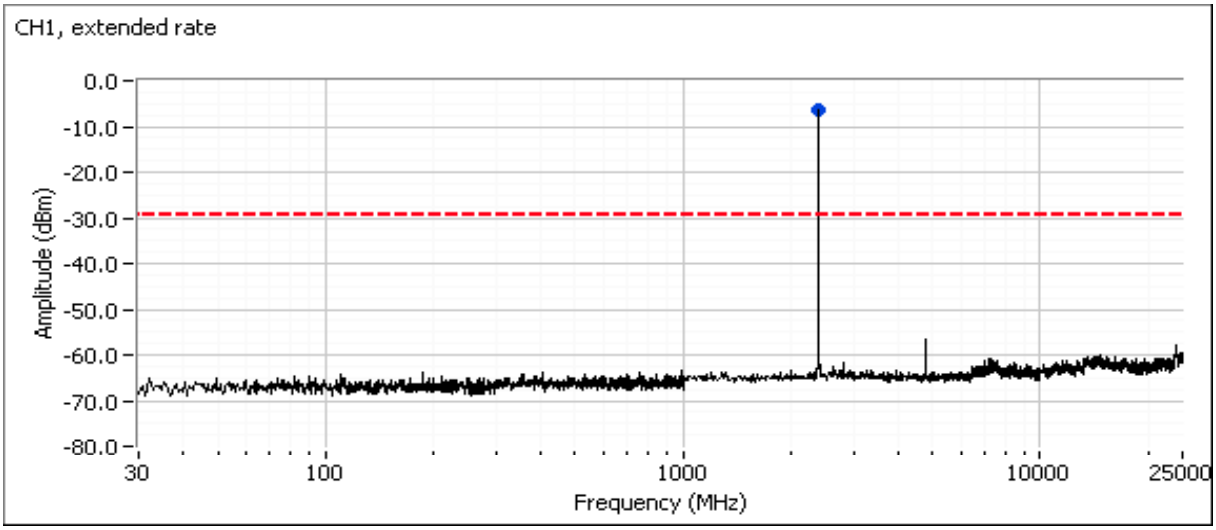
Run #1d: Antenna Conducted Spurious Emissions, 30 - 25,000 MHz.

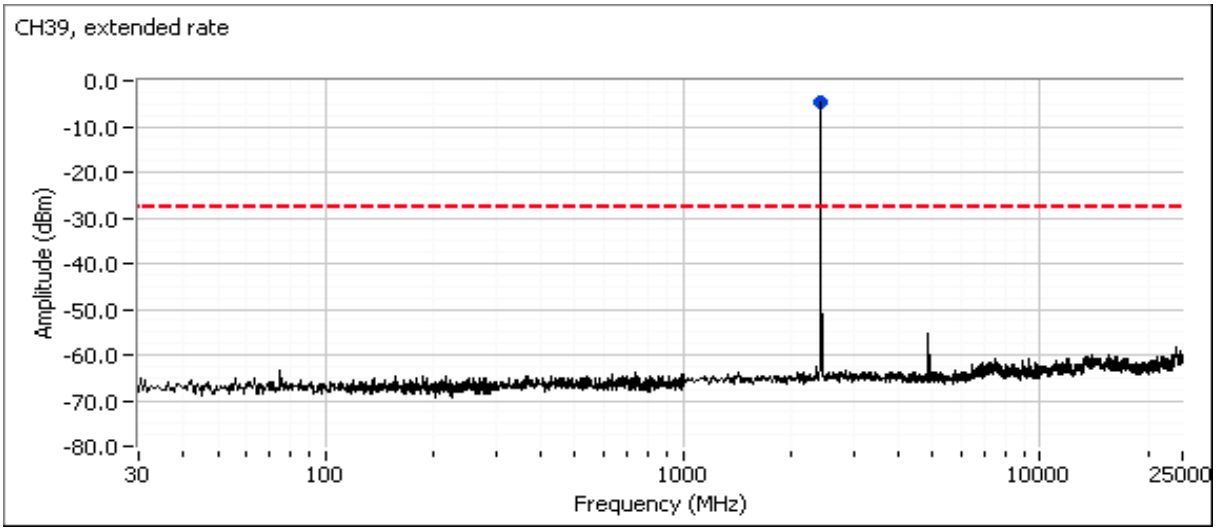
Date of Test: 5/18/2011

Test Engineer: John Caizzi

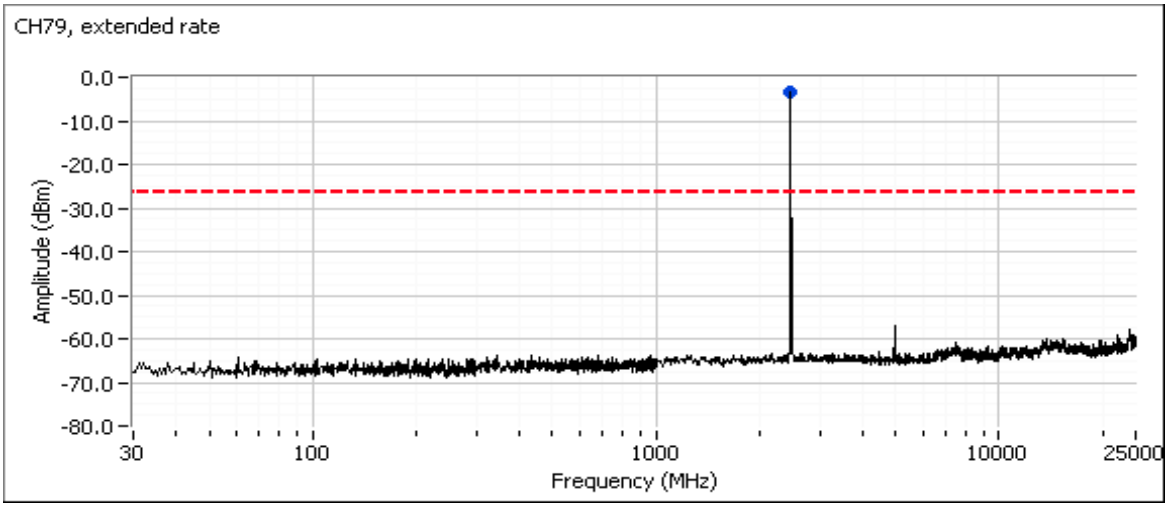
Test Location: FT7

Refer to plots below. Scans made using RBW=VB=100 KHz with the limit line set at 20dB below the highest in-band signal level.





Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	FCC 15.247/RSS-210	Class:	N/A



Run #2: Output Power

Date of Test: 5/18/2011

Test Engineer: John Caizzi

Test Location: FT7

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

Maximum antenna gain: 2 dBi

Channel	Frequency (MHz)	Res BW	Output Power (dBm)	Output Power (W)	EIRP (W)
Low	2402	NA	0.4	0.0011	0.0017
Mid	2440	NA	1.6	0.0014	0.0023
High	2480	NA	2.2	0.0017	0.0026

Note 1:	Output power measured with a peak power meter.

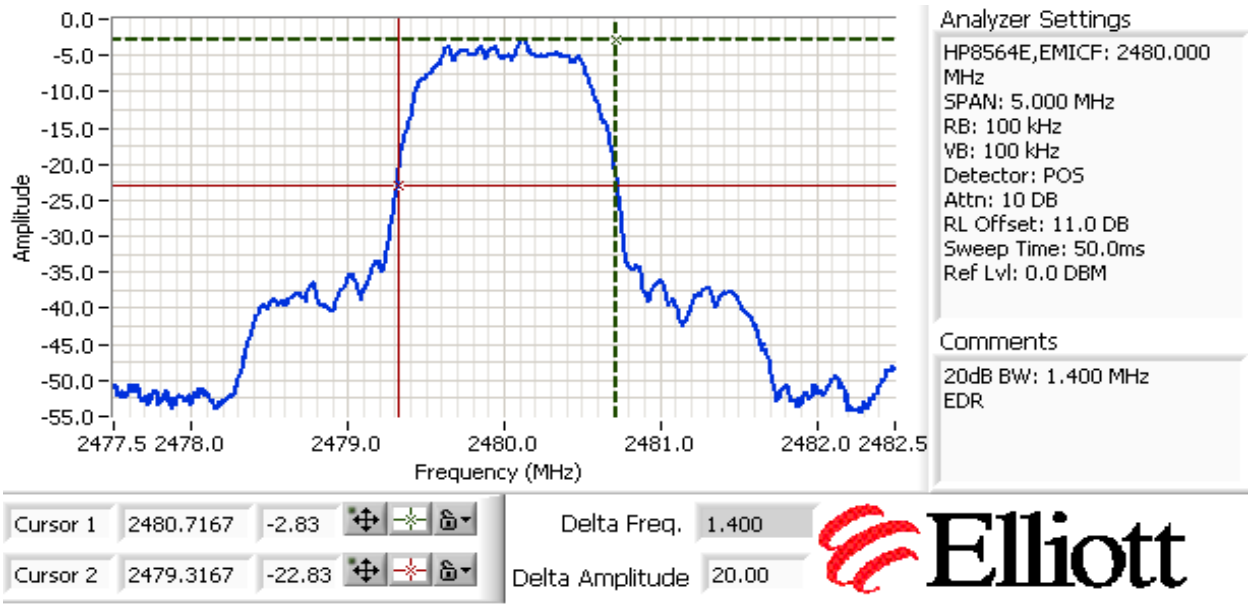
Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	FCC 15.247/RSS-210	Class:	N/A

Run #3: Bandwidth

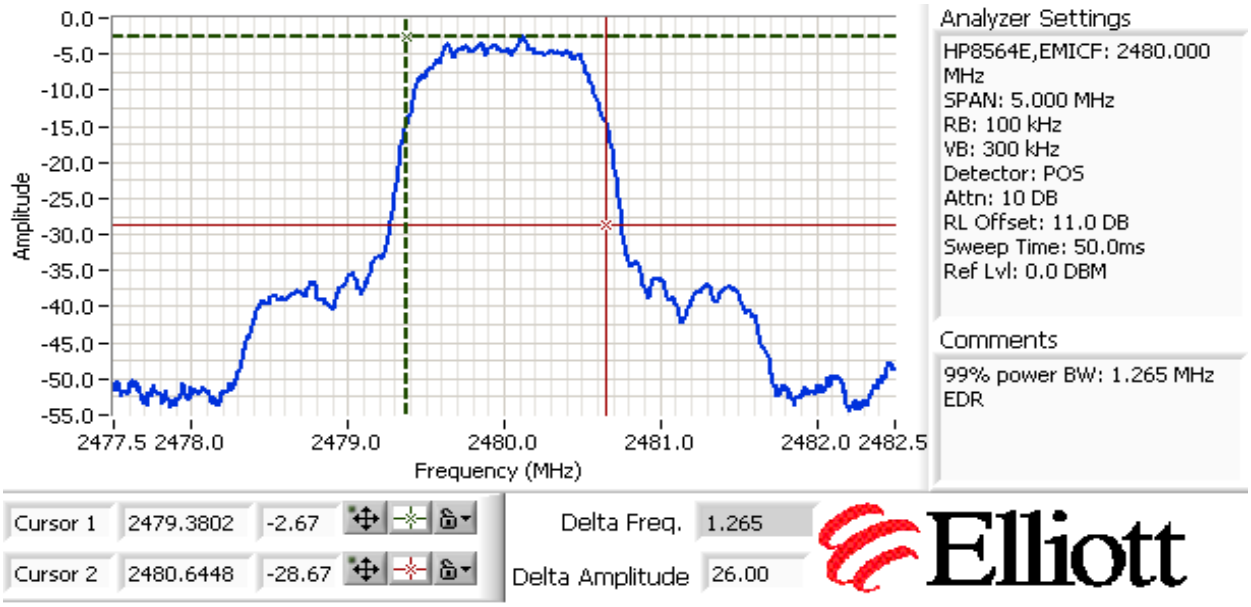
Date of Test: 5/18/2011
Test Engineer: John Caizzi
Test Location: FT7

Channel	Frequency (MHz)	Resolution Bandwidth	20dB Bandwidth (kHz)	Resolution Bandwidth	99% Bandwidth (kHz)
Low	2402	100 kHz	1383	100 kHz	1248
Mid	2440	100 kHz	1400	100 kHz	1265
High	2480	100 kHz	1400	100 kHz	1265

Note 1:	20dB bandwidth measured using RB = 100 kHz, VB = 100 kHz (VB > RB)
Note 2:	99% bandwidth measured using RB = 100 kHz, VB = 300 kHz (VB >=3RB)



Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	FCC 15.247/RSS-210	Class:	N/A



Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	FCC 15.247/RSS-210	Class:	N/A

Run #4: Channel Spacing and Number of Channels

Basic Mode

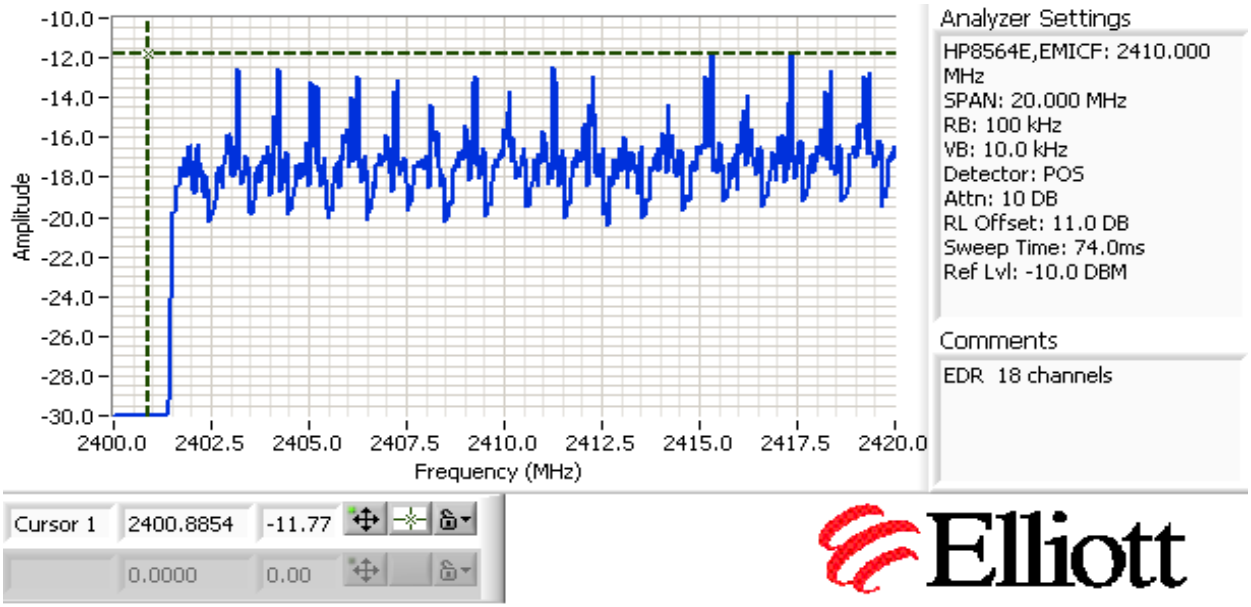
Channel Spacing: 1000 kHz

20dB Bandwidth: 1100 kHz

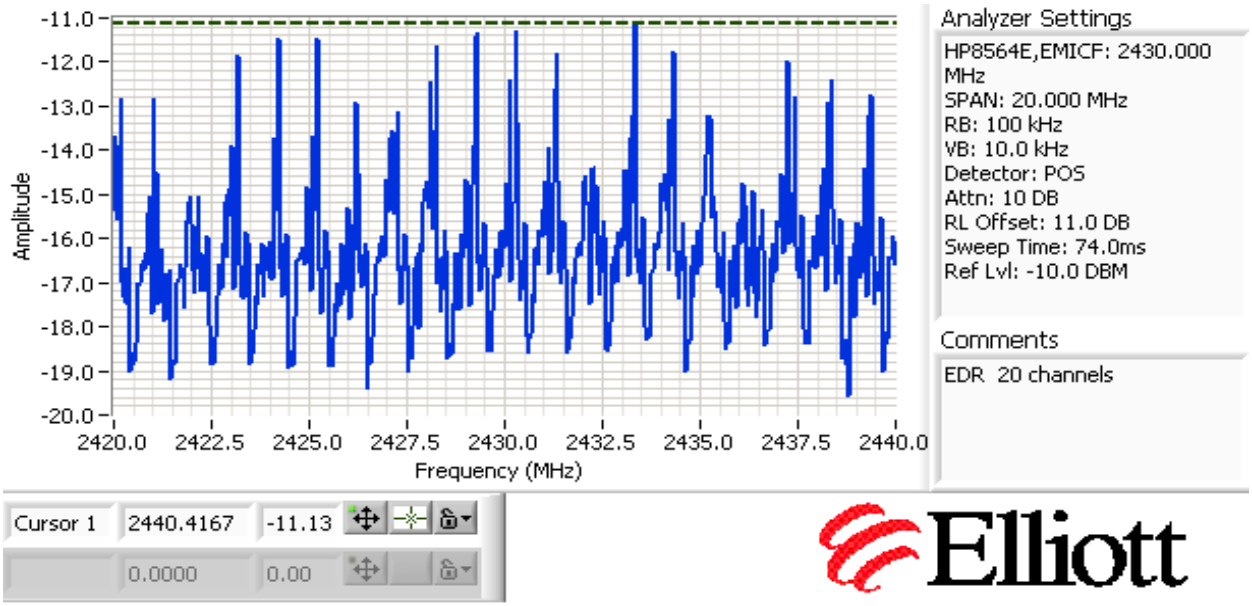
The channel spacing was measured in Basic rate mode with hopping enabled - see plot below showing channel spacing:
The channel spacing shall be greater than 2/3 times the widest 20dB bandwidth, as the ouput power is <0.125W.

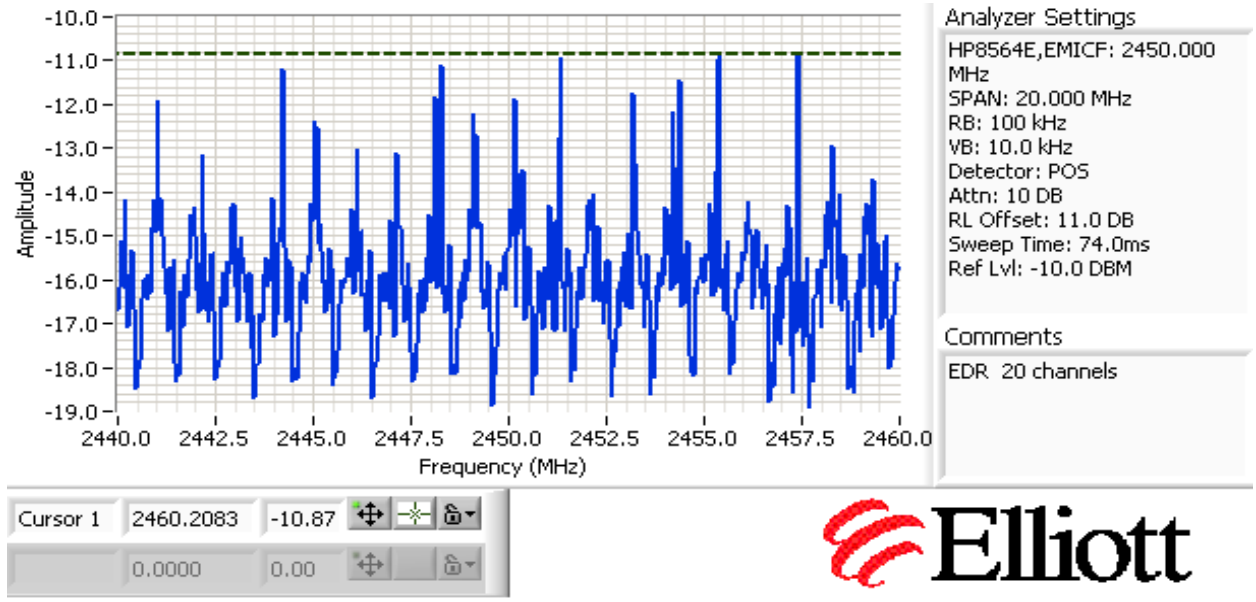
Number of channels: 79 Max 20 Min (AFH enabled)

The number of channels was measured in Basic rate mode with hopping enabled with both the maximum (all) channels enabled and with the minimum number of channels enabled. The system shall employ a minimum of 15 hopping channels.

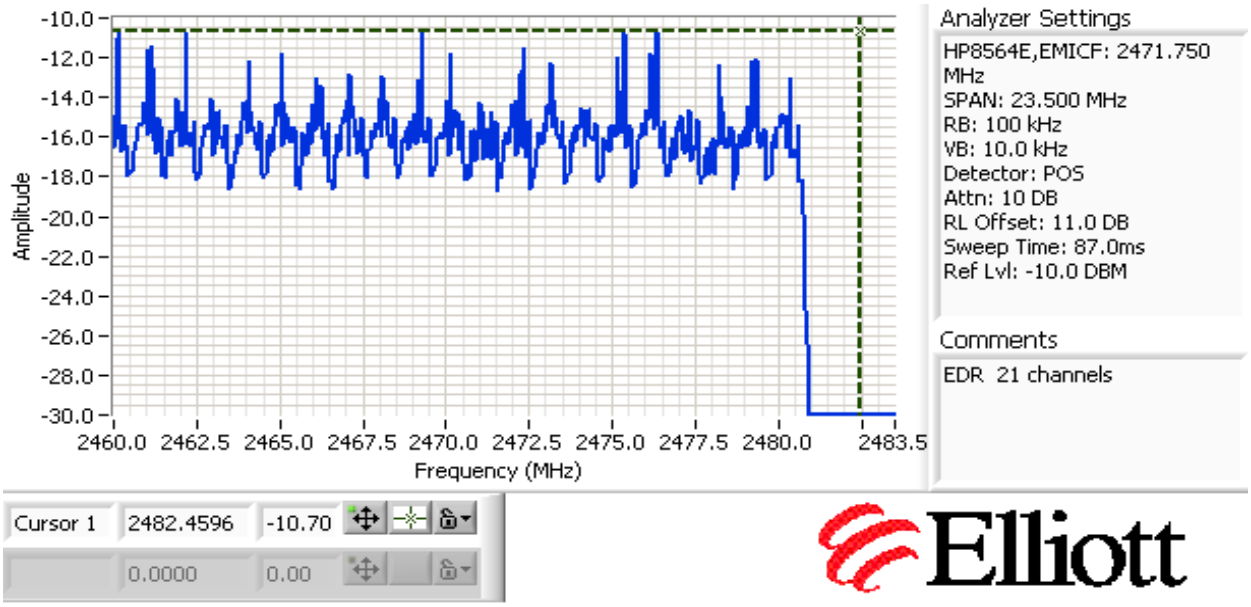


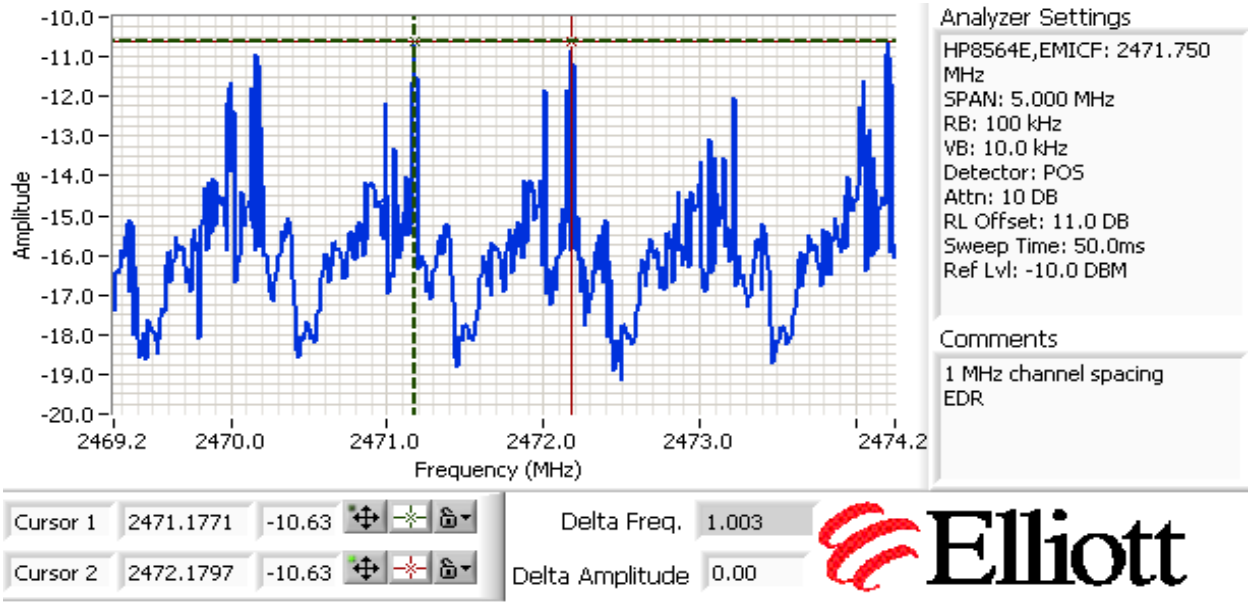
Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	FCC 15.247/RSS-210	Class:	N/A





Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83197
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	FCC 15.247/RSS-210	Class:	N/A





Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-WB40 and SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83198
		Account Manager:	Christine Krebill
Contact:	Ron Seide		-
Emissions Standard(s):	EN 301 489-1 V1.8.1/ FCC Part 15B	Class:	B
Immunity Standard(s):	EN 301 489-1 V1.8.1	Environment:	-

EMC Test Data

For The

Summit Data Communications

Model

SDC-WB40 and SDC-MSD40NBT (1x1 802.11abg + BT 2.1)

Date of Last Test: 12/16/2011

EMC Test Data

Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-WB40 and SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83198
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	EN 301 489-1 V1.8.1/ FCC Part 15B	Class:	B

Conducted Emissions

(Elliott Laboratories Fremont Facility, Semi-Anechoic Chamber)

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 12/16/2011
Test Engineer: John Caizzi
Test Location: Fremont Chamber #5

Config. Used: 2
Config Change: none
Host Unit Voltage 120V / 60Hz & 230V / 50Hz

General Test Configuration

For tabletop equipment, the EUT host system was located on a wooden table inside the semi-anechoic chamber, 40 cm from a vertical coupling plane and 80cm from the LISN. The EUT was transmitting on 2437 MHz, 802.11g, 6 Mbps.

Ambient Conditions:

Temperature: 21 °C
Rel. Humidity: 33 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power, 230V/50Hz	Class B	Pass	31.0dBµV @ 0.687MHz (-15.0dB)
2	CE, AC Power,120V/60Hz	Class B	Pass	31.9dBµV @ 19.501MHz (-18.1dB)

Modifications Made During Testing

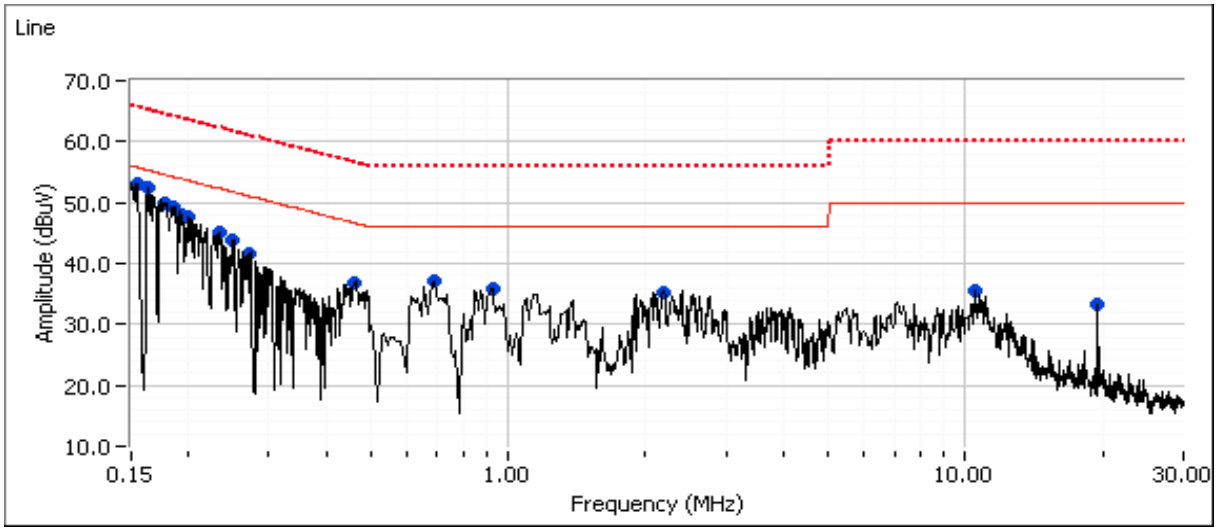
No modifications were made to the EUT during testing

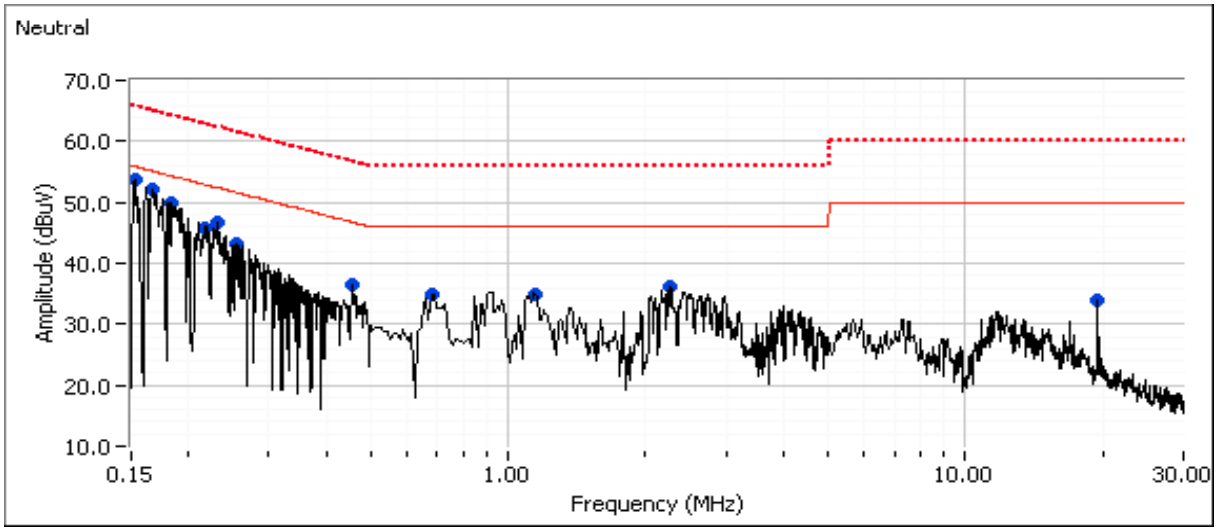
Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-WB40 and SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83198
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	EN 301 489-1 V1.8.1/ FCC Part 15B	Class:	B

Run #1: AC Power Port Conducted Emissions, 0.15 - 30MHz, 230V/50Hz





EMC Test Data

Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-WB40 and SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83198
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	EN 301 489-1 V1.8.1/ FCC Part 15B	Class:	B

Preliminary peak readings captured during pre-scan (peak readings vs. average limit)

Frequency MHz	Level dBμV	AC Line	Class B Limit	Margin	Detector QP/Ave	Comments
0.153	53.0	Line	55.8	-2.8	Peak	
0.163	52.3	Line	55.3	-3.0	Peak	
0.178	49.8	Line	54.6	-4.8	Peak	
0.185	49.1	Line	54.3	-5.2	Peak	
0.195	48.1	Line	53.9	-5.8	Peak	
0.202	47.6	Line	53.6	-6.0	Peak	
0.234	45.1	Line	52.3	-7.2	Peak	
0.250	43.9	Line	51.7	-7.8	Peak	
0.687	37.0	Line	46.0	-9.0	Peak	
0.271	41.5	Line	51.1	-9.6	Peak	
0.464	36.9	Line	46.6	-9.7	Peak	
0.916	35.9	Line	46.0	-10.1	Peak	
2.173	35.2	Line	46.0	-10.8	Peak	
10.533	35.6	Line	50.0	-14.4	Peak	
19.501	33.3	Line	50.0	-16.7	Peak	
0.153	53.7	Neutral	55.8	-2.1	Peak	
0.167	52.1	Neutral	55.1	-3.0	Peak	
0.185	49.8	Neutral	54.3	-4.5	Peak	
0.232	46.7	Neutral	52.4	-5.7	Peak	
0.217	45.8	Neutral	52.9	-7.1	Peak	
0.255	43.2	Neutral	51.6	-8.4	Peak	
2.279	36.3	Neutral	46.0	-9.7	Peak	
0.458	36.6	Neutral	46.7	-10.1	Peak	
0.685	35.0	Neutral	46.0	-11.0	Peak	
1.141	34.8	Neutral	46.0	-11.2	Peak	
19.502	34.0	Neutral	50.0	-16.0	Peak	

EMC Test Data

Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-WB40 and SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83198
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	EN 301 489-1 V1.8.1/ FCC Part 15B	Class:	B

Final quasi-peak and average readings

Frequency MHz	Level dBμV	AC Line	Class B Limit	Margin	Detector QP/Ave	Comments
0.153	17.5	Line	55.8	-38.3	AVG	
0.153	46.1	Line	65.8	-19.7	QP	
0.163	16.8	Line	55.3	-38.5	AVG	
0.163	44.7	Line	65.3	-20.6	QP	
0.178	16.1	Line	54.6	-38.5	AVG	
0.178	42.8	Line	64.6	-21.8	QP	
0.185	15.9	Line	54.3	-38.4	AVG	
0.185	41.8	Line	64.3	-22.5	QP	
0.195	15.7	Line	53.8	-38.1	AVG	
0.195	40.8	Line	63.8	-23.0	QP	
0.202	15.4	Line	53.5	-38.1	AVG	
0.202	40.1	Line	63.5	-23.4	QP	
0.687	31.0	Line	46.0	-15.0	AVG	
0.687	36.5	Line	56.0	-19.5	QP	
0.463	25.5	Line	46.6	-21.1	AVG	
0.463	34.1	Line	56.6	-22.5	QP	
0.916	28.9	Line	46.0	-17.1	AVG	
0.916	34.9	Line	56.0	-21.1	QP	
2.173	7.9	Line	46.0	-38.1	AVG	
2.173	33.6	Line	56.0	-22.4	QP	
10.533	20.5	Line	50.0	-29.5	AVG	
10.533	30.6	Line	60.0	-29.4	QP	
19.501	31.1	Line	50.0	-18.9	AVG	
19.501	32.0	Line	60.0	-28.0	QP	
0.153	17.6	Neutral	55.8	-38.2	AVG	
0.153	46.2	Neutral	65.8	-19.6	QP	
0.167	16.5	Neutral	55.1	-38.6	AVG	
0.167	44.3	Neutral	65.1	-20.8	QP	
0.185	15.8	Neutral	54.3	-38.5	AVG	
0.185	42.1	Neutral	64.3	-22.2	QP	
0.232	21.4	Neutral	52.4	-31.0	AVG	
0.232	37.5	Neutral	62.4	-24.9	QP	
0.216	14.6	Neutral	53.0	-38.4	AVG	
0.216	39.2	Neutral	63.0	-23.8	QP	
2.279	25.1	Neutral	46.0	-20.9	AVG	
2.279	32.6	Neutral	56.0	-23.4	QP	
0.458	28.8	Neutral	46.7	-17.9	AVG	
0.458	33.8	Neutral	56.7	-22.9	QP	

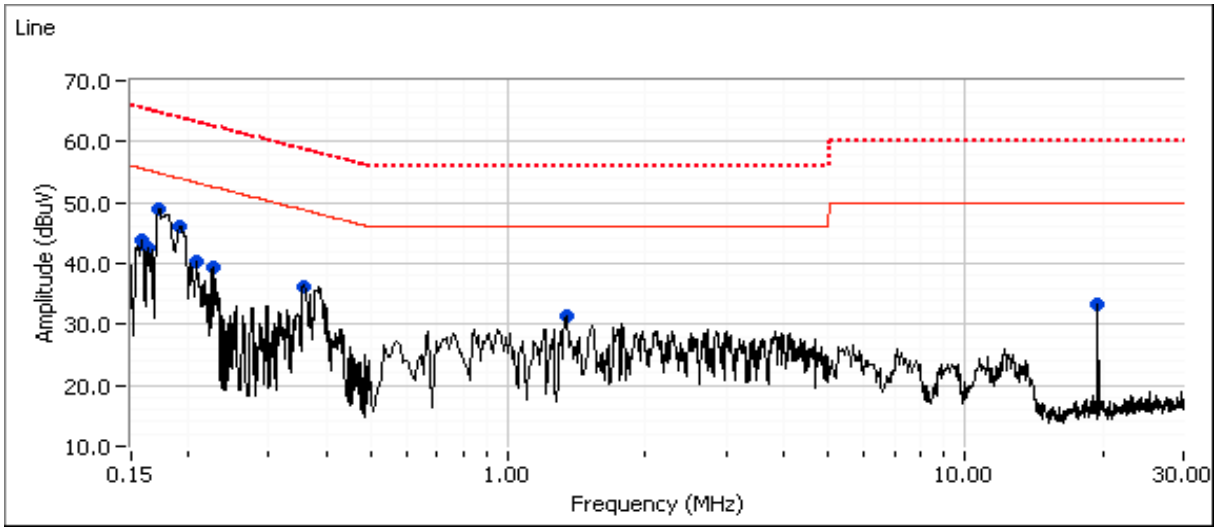
EMC Test Data

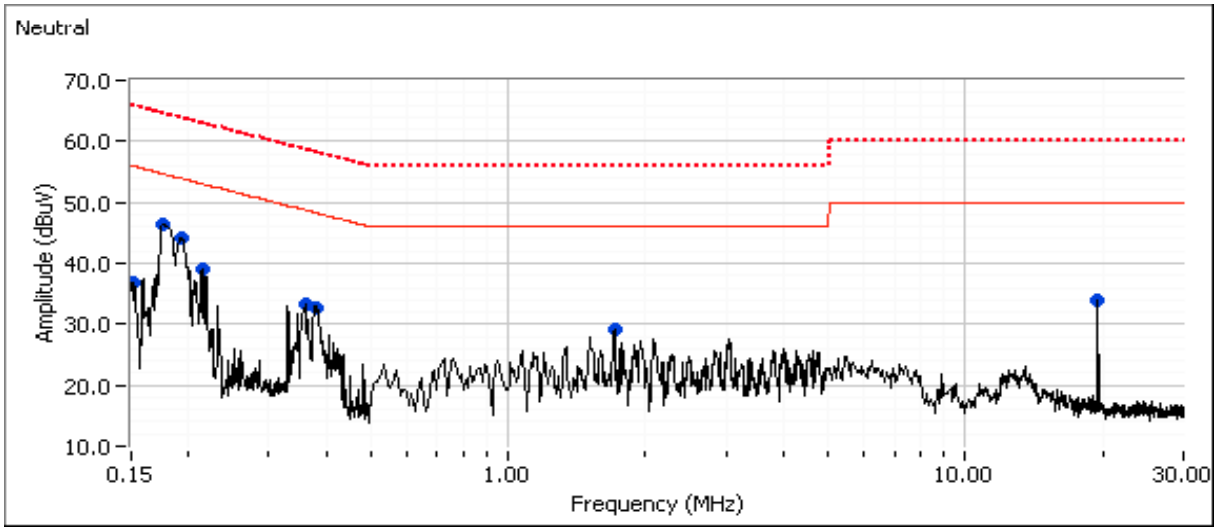
Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-WB40 and SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83198
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	EN 301 489-1 V1.8.1/ FCC Part 15B	Class:	B

Frequency MHz	Level dBµV	AC Line	Class B Limit	Margin	Detector QP/Ave	Comments
0.685	29.4	Neutral	46.0	-16.6	AVG	
0.685	34.8	Neutral	56.0	-21.2	QP	
1.141	27.7	Neutral	46.0	-18.3	AVG	
1.141	34.5	Neutral	56.0	-21.5	QP	
19.502	30.2	Neutral	50.0	-19.8	AVG	
19.502	31.3	Neutral	60.0	-28.7	QP	

Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-WB40 and SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83198
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	EN 301 489-1 V1.8.1/ FCC Part 15B	Class:	B

Run #2: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz





EMC Test Data

Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-WB40 and SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83198
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	EN 301 489-1 V1.8.1/ FCC Part 15B	Class:	B

Preliminary peak readings captured during pre-scan (peak readings vs. average limit)

Frequency MHz	Level dBμV	AC Line	Class B Limit	Margin	Detector QP/Ave	Comments
0.173	48.8	Line	54.8	-6.0	Peak	
0.190	46.2	Line	53.9	-7.7	Peak	
0.158	43.8	Line	55.5	-11.7	Peak	
0.357	36.3	Line	48.8	-12.5	Peak	
0.164	42.5	Line	55.3	-12.8	Peak	
0.208	40.4	Line	53.3	-12.9	Peak	
0.225	39.3	Line	52.6	-13.3	Peak	
1.337	31.4	Line	46.0	-14.6	Peak	
19.502	33.2	Line	50.0	-16.8	Peak	
0.176	46.4	Neutral	54.7	-8.3	Peak	
0.192	44.0	Neutral	53.9	-9.9	Peak	
0.213	39.1	Neutral	53.0	-13.9	Peak	
0.379	32.8	Neutral	48.3	-15.5	Peak	
0.360	33.2	Neutral	48.7	-15.5	Peak	
19.501	34.0	Neutral	50.0	-16.0	Peak	
1.717	29.2	Neutral	46.0	-16.8	Peak	
0.152	36.9	Neutral	55.9	-19.0	Peak	

EMC Test Data

Client:	Summit Data Communications	Job Number:	J78403
Model:	SDC-WB40 and SDC-MSD40NBT (1x1 802.11abg + BT 2.1)	T-Log Number:	T83198
		Account Manager:	Christine Krebill
Contact:	Ron Seide		
Standard:	EN 301 489-1 V1.8.1/ FCC Part 15B	Class:	B

Final quasi-peak and average readings

Frequency MHz	Level dBμV	AC Line	Class B Limit	Margin	Detector QP/Ave	Comments
0.173	14.0	Line	54.8	-40.8	AVG	
0.173	44.3	Line	64.8	-20.5	QP	
0.190	33.5	Line	54.0	-20.5	AVG	
0.190	44.4	Line	64.0	-19.6	QP	
0.158	12.7	Line	55.6	-42.9	AVG	
0.158	31.5	Line	65.6	-34.1	QP	
0.357	10.7	Line	48.8	-38.1	AVG	
0.357	32.2	Line	58.8	-26.6	QP	
0.164	14.3	Line	55.3	-41.0	AVG	
0.164	41.0	Line	65.3	-24.3	QP	
0.208	16.0	Line	53.3	-37.3	AVG	
0.208	34.6	Line	63.3	-28.7	QP	
0.225	11.7	Line	52.6	-40.9	AVG	
0.225	23.9	Line	62.6	-38.7	QP	
1.337	21.3	Line	46.0	-24.7	AVG	
1.337	29.5	Line	56.0	-26.5	QP	
19.502	29.8	Line	50.0	-20.2	AVG	
19.502	30.4	Line	60.0	-29.6	QP	
0.176	16.4	Neutral	54.7	-38.3	AVG	
0.176	44.4	Neutral	64.7	-20.3	QP	
0.192	27.9	Neutral	53.9	-26.0	AVG	
0.192	42.6	Neutral	63.9	-21.3	QP	
0.213	12.2	Neutral	53.1	-40.9	AVG	
0.213	33.1	Neutral	63.1	-30.0	QP	
0.379	23.7	Neutral	48.3	-24.6	AVG	
0.379	30.7	Neutral	58.3	-27.6	QP	
0.360	17.3	Neutral	48.7	-31.4	AVG	
0.360	29.3	Neutral	58.7	-29.4	QP	
19.501	31.9	Neutral	50.0	-18.1	AVG	
19.501	32.6	Neutral	60.0	-27.4	QP	
1.717	10.7	Neutral	46.0	-35.3	AVG	
1.717	18.8	Neutral	56.0	-37.2	QP	
0.152	11.4	Neutral	55.9	-44.5	AVG	
0.152	30.6	Neutral	65.9	-35.3	QP	

End of Report

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