



Wireless Transceiver Test Report

FCC ID: A94Z5GBT IC: 3232A-Z5GBT



Certificate # 1514.1

Report number: EMC.400360.09.197.2

Prepared for: Bose Corporation
DCE - EMC
1 New York Ave, Framingham MA 01701

Product Tested: SoundDock 10 including optional 10 BT link

Standards: FCC part 15, RSS210, RSS-gen and ICES-003

Report prepared by: Peter Boers

Signature:

Report reviewed by: Brent DeWitt

Signature:

Report issue date: August 31, 2009

Report Revision 2

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1 Report Summary

1.1 Product : SoundDock 10 Bluetooth adapter

1.2 Client : Bose Corporation
The Mountain, Framingham MA 01701

1.3 Applicable Standards: FCC part 15.247
RSS210 issue 7 (June 2007)

Test Results: Pass Fail

1.4 Test Laboratory Bose DCE laboratories
1 New York Ave
Framingham, MA 01701.
IC registration : 3232A
FCC site registration under A2LA cert. #1514

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2 Product description

The SoundDock 10 Bluetooth link is an optional plug-in dock enabling a Bluetooth connection from a cell phone, PDA or other device to the SoundDock 10 enabling the reproduction of music from any Bluetooth enabled audio source.

The Bluetooth dock is unique to the SoundDock 10 and cannot be mounted in or operated with any other device. It contains an integral antenna which is not accessible by the user without irreparably breaking the plastic housing.

The SoundDock 10 is classified as a Bluetooth data "sink" with a duty cycle that does not exceed 5% in normal operation. For the purposes of the tests described in this report, where an artificial test mode is indicated or necessary for the purposes of the test, the SoundDock 10 Bluetooth adaptor is operated with a 10% duty cycle which is considered a worst-worst case for the purposes of these tests.

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3. Applicable standards, requirements and tests

FCC part 15	RSS210	RSS-gen	Test references.	Result
15.15(b)		5.3	There are no user-accessible controls for the adjustment of any transmitter parameters in the device under test.	Complies
15.27			There are no special devices such as shielded cables or special connectors required for compliance to the applicable standards.	Complies
15.203			The device does not operate in either the US or Canadian restricted bands.	Complies
15.247 (a)(1)	A8.1 (b)		Occupied Bandwidth / channel spacing	Section 6.1
15.247 (b)(1)	A8.4 (4)		Transmitter output power:	Section 6.2
15.247(a) (1) iii	A8.3 (1)		Time occupancy of a frequency hopper	Section 6.3
15.247(d)	2.2(b)		Radiated spurious emissions 1- 25 GHz	Section 6.4
15.247(d)	2.2(b)		Transmitter harmonics	Section 6.4
15.247(d)	7.2.3		Transmitter conducted spurious emissions	Section 6.5
	6(b)	7.2.3	Receiver conducted spurious emissions	Section 6.6
15.107 15.207		7.2.2	Conducted emissions, 150kHz–30 MHz	Section 6.7
15.109 15.209			Radiated emissions, 30MHz–1GHz Spurious emissions, 30MHz–1GHz	Section 6.8
OET65	Canada Health and Safety code 6		MPE calculation	Section 6.9

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4 Environmental Conditions

All testing is performed under the following conditions, unless otherwise defined in the detail test report section.

Temperature: 22 ± 4 °C

Humidity: 30 – 60 % RH

5 EUT configuration.

The EUT is placed in the host unit, which provides the power and data/control interface. A Bluetooth device is paired up and an A2DP data link is established for normal audio testing. For specific radio tests a Bluetooth tester is used to provide the link capabilities.

When tests are made with the Bluetooth tester, the EUT is placed in “test mode”.

The host unit is operated and installed consistent with the requirements defined in ANSI C63.4. Testing un-intentional radiated and conducted emissions from the “digital device” attributes of the product is done with the audio level adjusted for maximum emissions and a pink-noise audio signal.

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6. Detailed Test Results.

6.1. Occupied Bandwidth

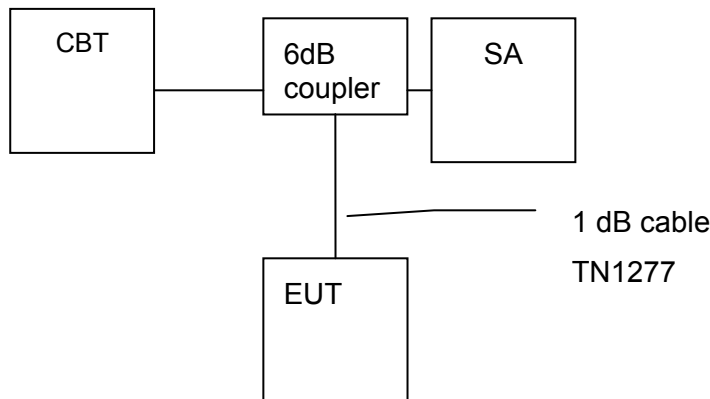
6.1.1. Requirements

The Occupied Bandwidth to be measured in the low, mid and high channels.

FCC part 15.247(a)(1): The hopping channel carrier frequencies are separated by at least 2/3rd of the 20dB Bandwidth provided the output power is less than 125 mW (20.96 dBm)

6.1.2. Test setup details

Block diagram:



6.1.3. Test data

Summary : EDR mode packet 3-DH5 (worst case)

BT Channel	Center Frequency (MHz)	20dB OBW (kHz)	99% OBW (kHz)
0	2402	1373	1253
39	2441	1363	1242
78	2480	1403	1232

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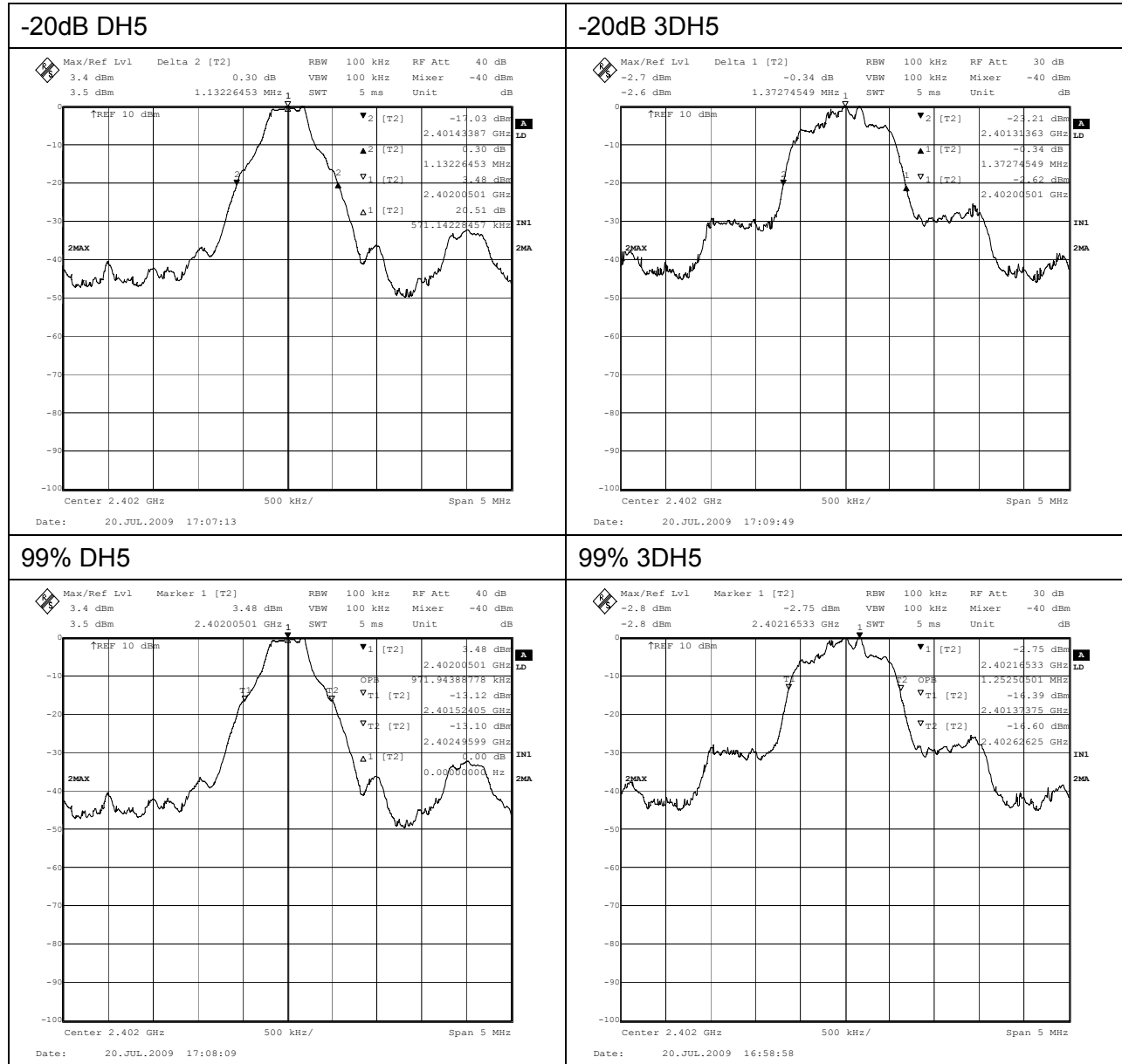


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Low channel



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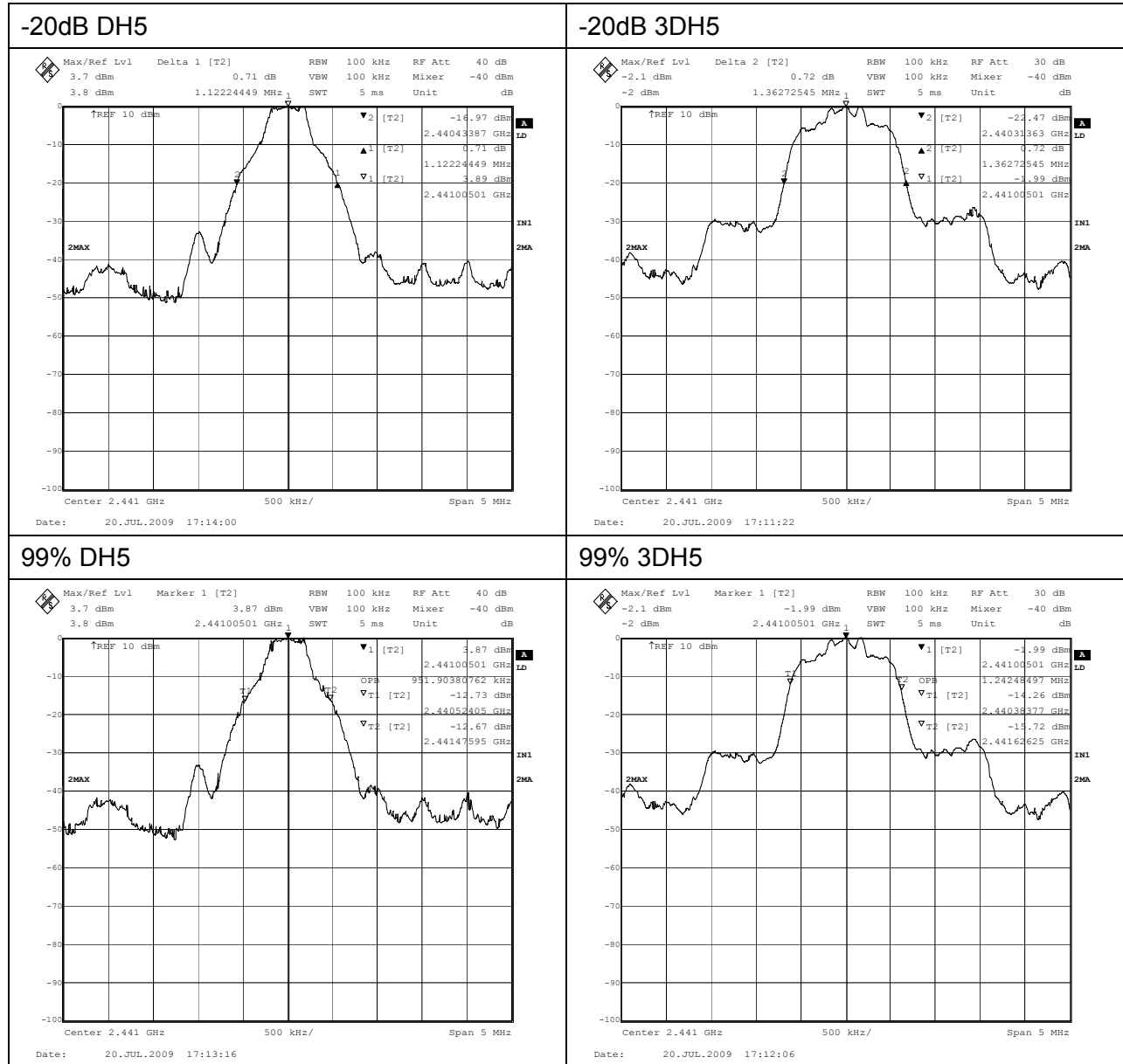


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Mid channel



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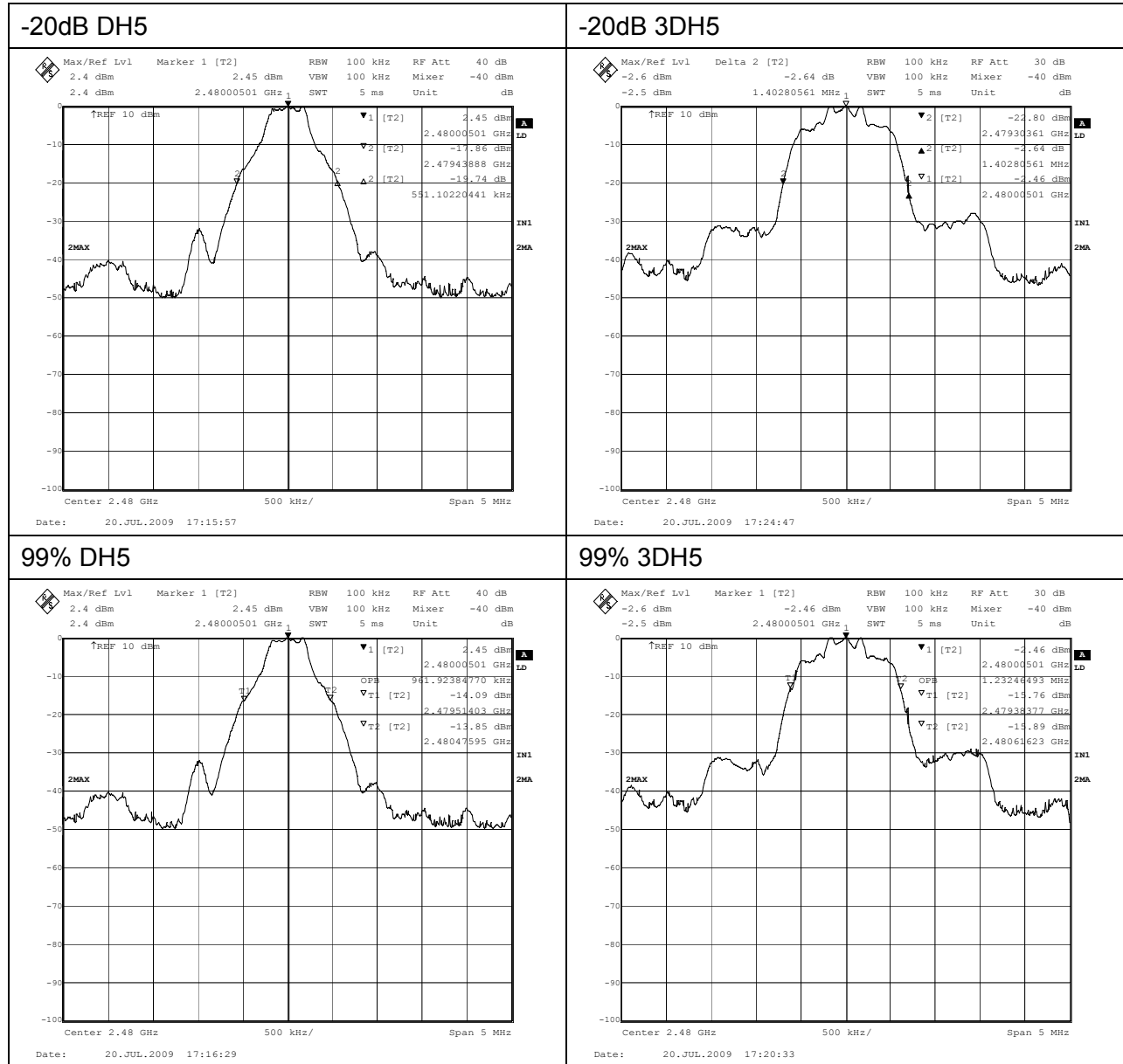


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High channel



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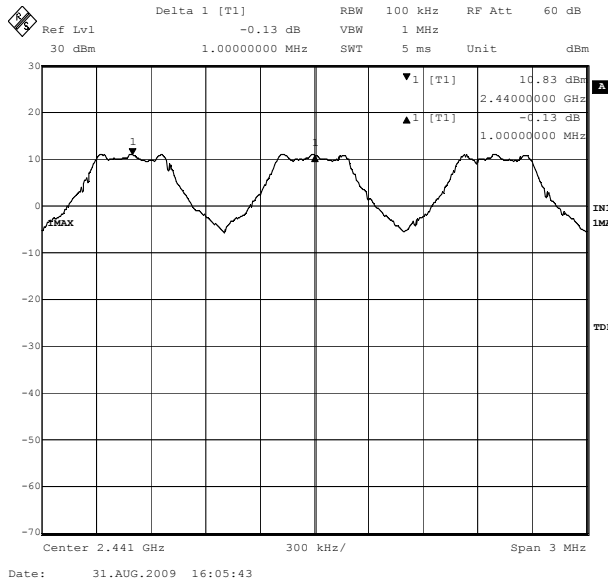


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Channel Separation: 1 MHz



Conclusion: $2/3^{\text{rd}}$ of the largest OBW = $2/3 \times 1403 \text{ kHz} = 935.33 \text{ kHz}$, which is less than the carrier channel separation of 1 MHz. In addition, the output power is less than 125 mW

6.1.4. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service date	
				Last	Due
Spectrum analyzer	Rohde & Schwarz	ESIB40	TN1560	3/3/2009	3/3/2010
Bluetooth Analyzer	Rohde & Schwarz	CBT	TN1758	5/15/2009	5/15/2010

6.1.5. Test information

Date of test:	July 20 & Aug 31, 2009	Test Location	TX test bench
EUT serial:	Alpha 58AE	Test by:	Peter Boers
Result:	Pass		

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6.2. Peak output power

6.2.1. Requirements.

FCC 15.247(b)(1), RSS-210 section A8.4 (4).
The output power shall be less than 1 W (30 dBm)

6.2.2. Test setup details.

The transceiver is modified with special firmware enabling the control of the Bluetooth radio chip via a R&S Bluetooth tester enabling "test mode". The EUT antenna is removed and replaced with an SMA connector, and connected with a 36" low loss cable (TN1277) to the input of a spectrum analyzer. The transceiver is operated in an artificial test mode controlled by the R&S CBT Bluetooth tester. The EUT is programmed to stop hopping and operated at fixed frequencies at the low end, middle and high end of the authorized frequency band.

The SA resolution bandwidth is set to 2 MHz (higher than the OBW in EDR mode), peak detector and max hold. The maximum output power is recorded for low, mid and high band frequencies. The maximum output power settings are different for basic rate and for Enhanced Data Rate (EDR) settings. Cable and coupler losses are programmed into the SA transducer factors.

In actual operation the output power of the device can be programmed over a range from a maximum of 11.2 dBm for basic rate or 7.2 dBm for EDR to a minimum of 0.25 dBm.

6.2.3. Test data.

Summary. RBW=2 MHz, detector=peak

Maximum output power

Channel	Frequency MHz	Basic Rate dBm	EDR dBm
0	2402	10.81	6.09
39	2441	11.2	7.16
78	2480	9.8	5.68

Minimum output power

Channel	Frequency MHz	Basic Rate dBm	EDR dBm
0	2402	-0.94	1.38
39	2441	0.24	2.87
78	2480	0.02	1.73

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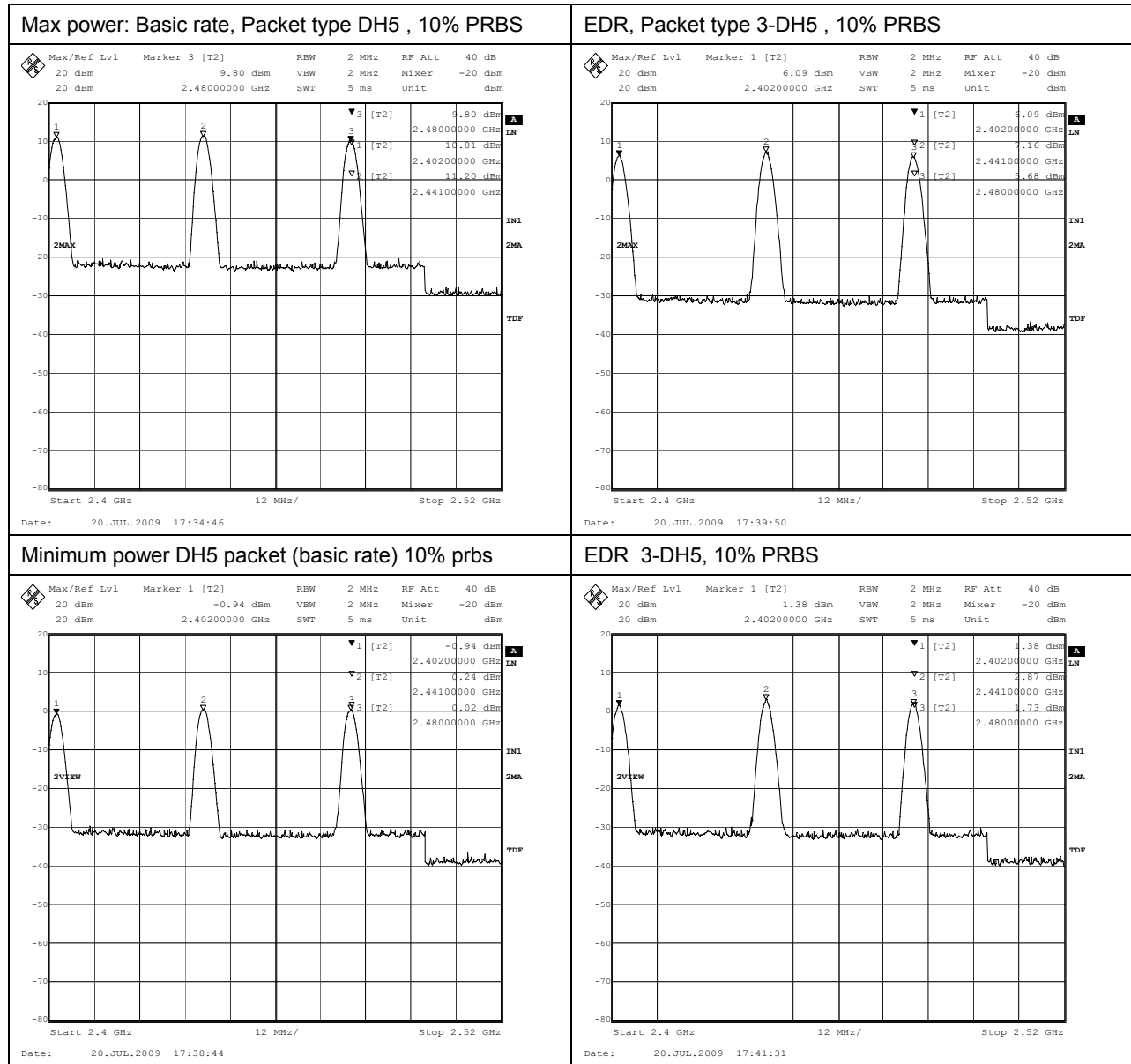


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Test detail:



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6.2.4. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service date	
				Last	Due
Spectrum analyzer	Rohde & Schwarz	ESIB40	TN1560	3/3/2009	3/3/2010
BT controller	Rohde & Schwarz	CBT	TN1758	5/15/2009	5/15/2010

6.2.5. Test information

Date of test:	July 20 2009	Test Location:	TX test bench
EUT serial:	Alpha 58AE	Tested by:	Peter Boers
Test result:	Pass		

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6.3. Time of occupancy

6.3.1. Requirements

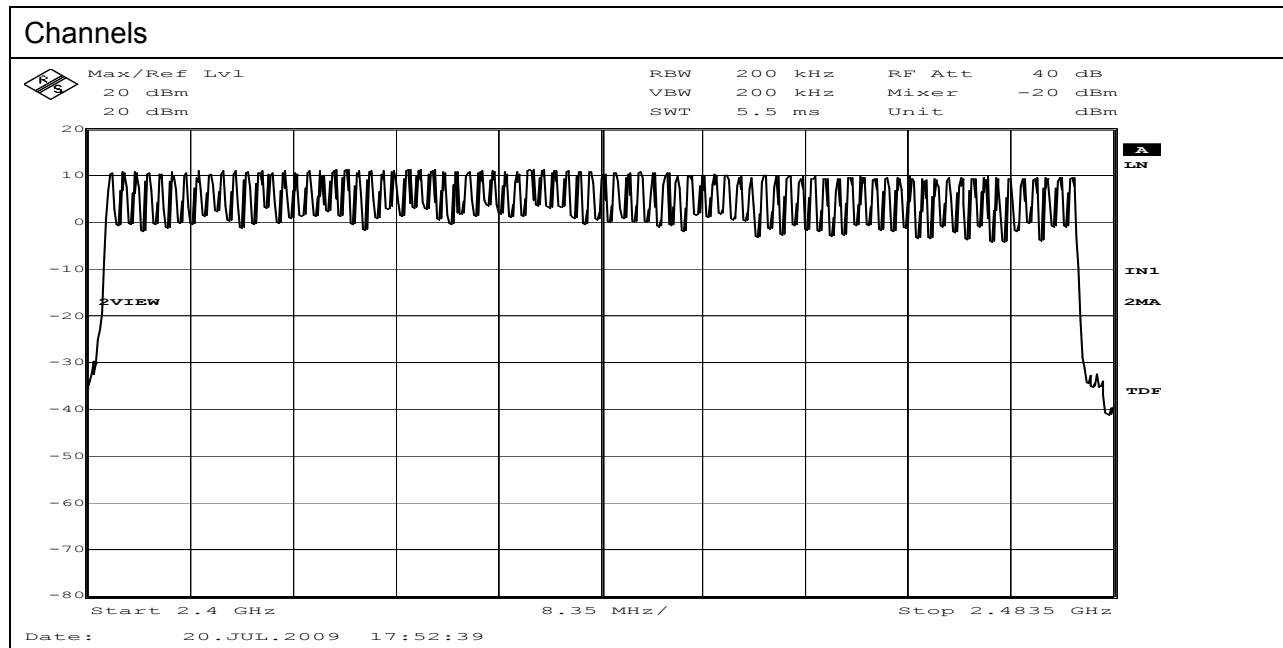
FCC 15.247 (a)(1)iii and RSS-210 section A8.3 (1).

The frequency hopping operation shall have an average time occupancy on any frequency not to exceed 0.4 seconds within the duration in seconds equal to the number of hopping frequencies employed multiplied by 0.4

6.3.2. Test setup details

The SA is connected to the EUT via a coupler. Cable and coupler loss factors are included in the SA transducer settings. The EUT is operating on its normal hop set. The SA sweep time is set to the number of hopping channels (79) times 0.4 seconds or 31.6 seconds. The SA is tuned to mid-band (2441MHz), set to a 200 kHz bandwidth in order to minimize bleed-over from adjacent channels and set to a single sweep.

6.3.3. Test data



There are 79 channels identified in this display

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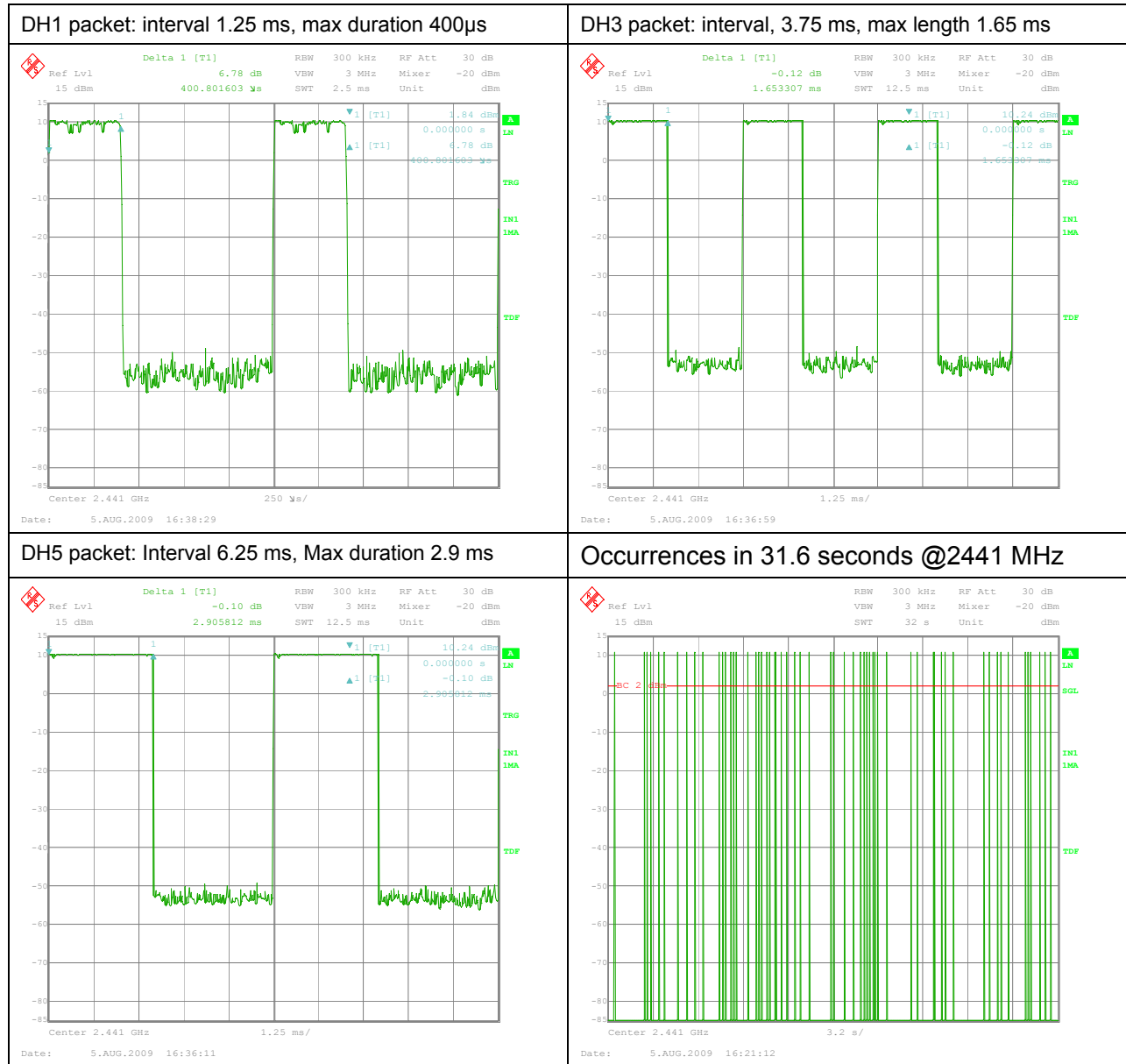
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For the purpose of this text, the payload of each packet has been adjusted to the maximum; therefore the duty cycle is much more than the normal operation of this type product. This presents a worst-possible case for this test. The largest dwell time of 2.9 ms was recorded with a DH5 packet. In this mode the number of "hits" on a given channel (channel 29 at 2441 MHz) was recorded. There are 71 occurrences; at a worst case dwell time of 2.9 ms this amounts to a total of 2.9ms time 71 = 206 ms. This meets the requirement of a maximum of 400ms.

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6.3.4. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service date	
				Last	Due
Spectrum analyzer	Rohde & Schwarz	ESIB40	TN1560	3/3/2009	3/3/2010
BT controller	Rohde & Schwarz	TN1758	5/15/2009	5/15/2010	TN1758

6.3.5. Test information

Date of test:	July 20, 2009	Test location:	TX test bench
EUT serial:	58AE	Tested by:	Peter Boers
Test result:	Pass		

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6.4. Radiated spurious emissions and harmonics, 1 -25 GHz

6.4.1. Requirements

In any of the restricted bands defined in FCC part 15.209(a) or RSS-210 Table 1, the field strength at a distance of 3 meters shall not exceed 54dB μ V/m average or 74dB μ V/m peak. Outside of the restricted bands, spurious emissions shall be at least 20dB below the wanted signal. The peak/average detector values of the wanted signal are 110/90 dBuV/m for basic rate modulation and 104/84 dBuV/m for EDR modulation. Using the lower values for EDR modulation the peak and average limits for spurious emissions outside the restricted bands would be 84/64 dBuV/m

6.4.2. Test setup details

The EUT is placed on a 80 cm high non-conductive table according to ANSI C63.4 and configured in a normal mode. The Bluetooth transceiver hopping is stopped and operated in the lower, middle and high end of the authorized band.

In addition spurious measurements are made in normal operation (hopping).

Radiated measurements are made at 3 meters distance, except above 18 GHz, where the measurement distance may be reduced to 30cm (or more) in order to achieve enough distance to the instrumentation noise floor. For each of the measurements, the EUT is rotated around its axis, and the measurement antenna is adjusted in height and polarization, and the spectrum scan data is collected using the max-hold mode of the spectrum analyzer. Measurements are made in the highest power mode with a pseudo-random bit sequence.

6.4.3. Test results

Summary:

Frequency [MHz] & Packet Type	Measured values		Limits		Margin dB	Notes
	Peak detector dB μ V/m @ 3m	Average Detector dB μ V/m @ 3m	Peak dB μ V/m	Average dB μ V/m		
1382		26.9	74	54	27.1	spurious
1605.5	47.9		74	54	26.1	spurious, band edge
1616.5	48.5		74	54	25.5	spurious
1635		34.5	84	64	29.5	spurious
1645.5	48.3		74	54	25.7	spurious
2400		42.2	84	64	21.8	spurious, band edge
4804, DH5	50.8	32.4	74	54	21.6	2nd harm. @ 2402, DH5
4804, 3-DH5	45.7	27.2	74	54	26.8	2nd harm. @ 2402, 3-DH5
4882, DH5	51.7	32.7	74	54	21.3	2nd harm. @ 2441, DH5
4882, 3-DH5	46.7	27.7	74	54	26.3	2nd harm. @ 2441, 3-DH5
4960, DH5	50.0	31.1	74	54	22.9	2nd harm. @ 2480, DH5
4960, 3DH5	44.9	26.5	74	54	27.5	2nd harm. @ 2480, 3-DH5
7206, DH5	41.4	26.8	84	64	37.2	3rd harm
7323, DH5	39.6	25.6	74	54	28.4	3rd harm
7440, DH5	40.4	26.3	74	54	27.7	3rd harm
9764	38.5	25.3	84	64	38.7	4th harm. Noise floor
12205	40.4	27.1	74	54	26.9	5th harm. Noise floor
14646	43.0	30.1	74	54	23.9	6th harm. Noise floor
17087	45.0	31.3	84	64	32.7	7th harm. Noise floor
19528	51.0	38.0	74	54	16	8th harm. Noise floor
21969	52.0	39.0	74	54	15	9th harm. Noise floor
24410	52.5	40.0	84	64	24	10th harm. Noise floor

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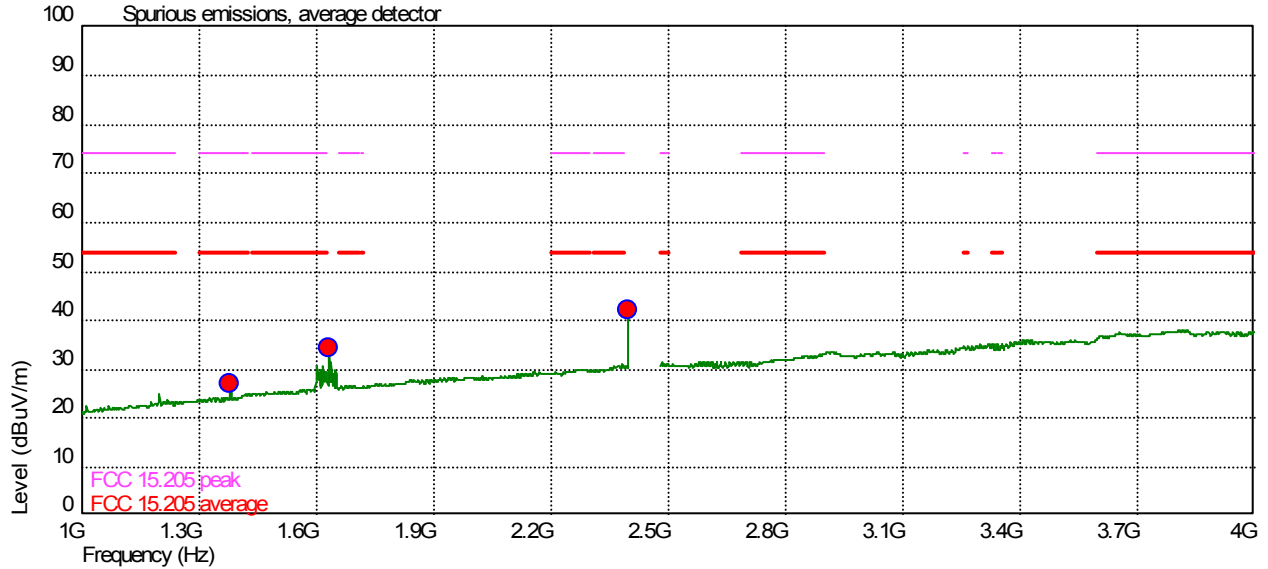
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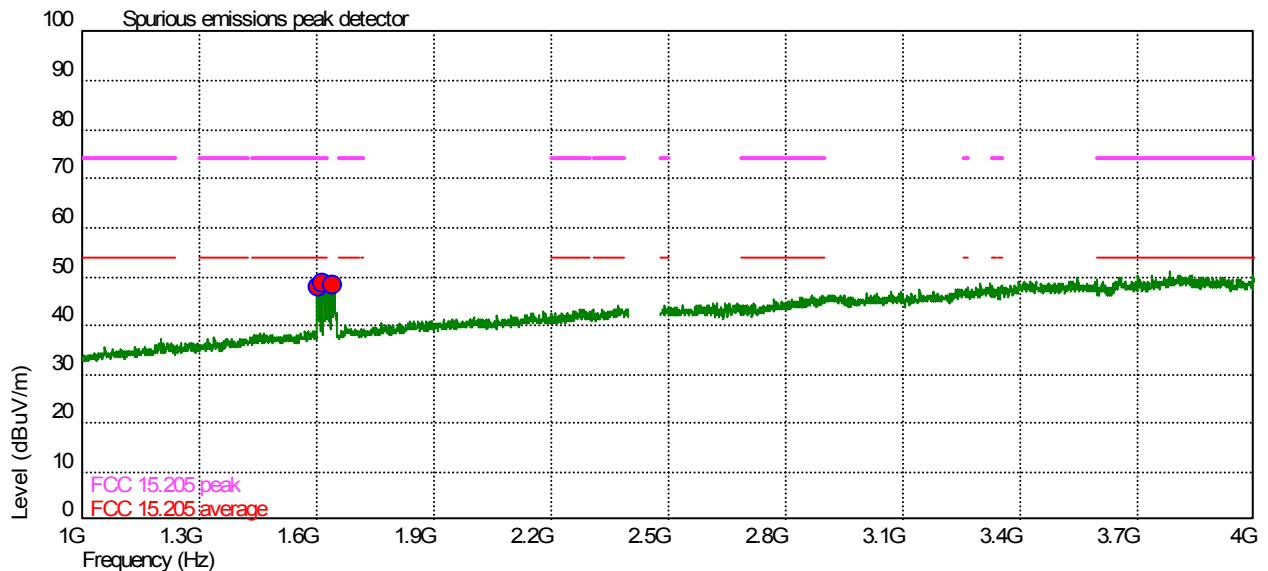
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Frequency range 1 – 4 GHz:

Average detector, 1MHz rbw, normal operation, hopping



Peak detector



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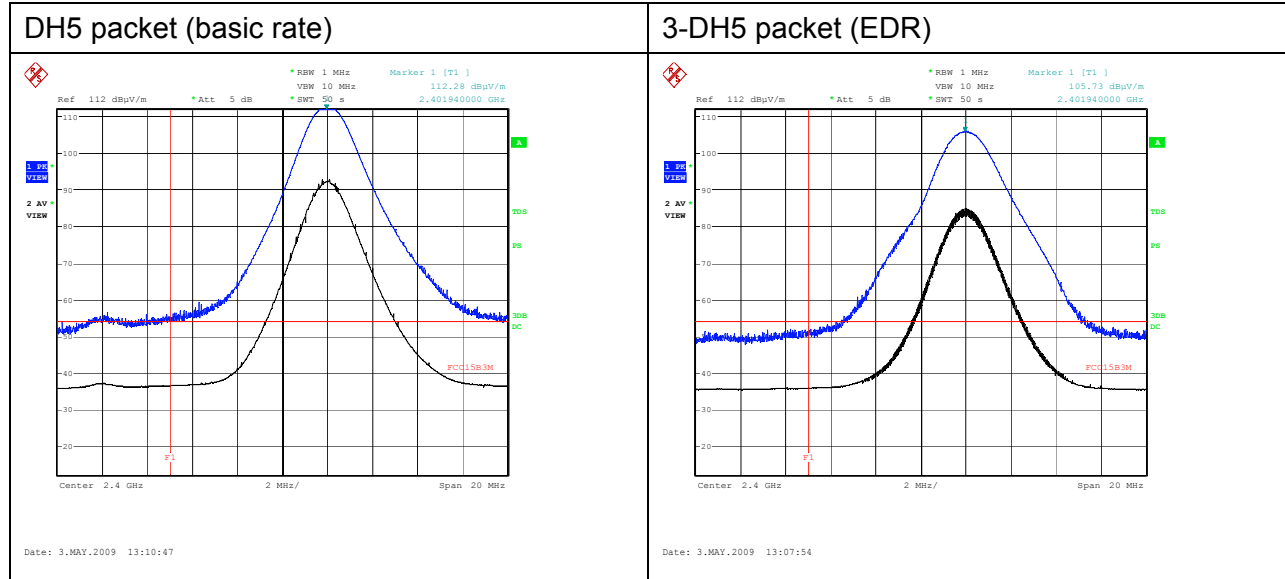
FCC ID: A94Z5GBT

IC: 3232A-Z5GBT

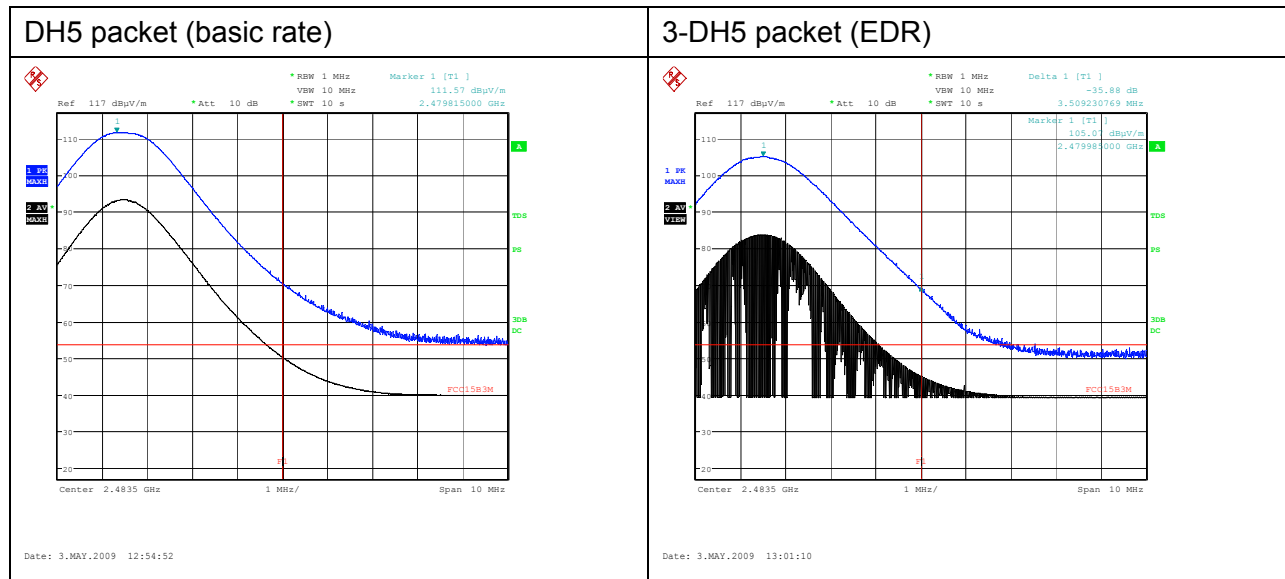
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Lower band edge @ 2.4 GHz

The EUT is positioned in the worst-case Table-azimuth and the antenna is adjusted in terms of height and polarization for the maximum measured emission. Peak (blue trace) and average (black trace) detector



Higher band edge @ 2.4835 GHz



Peak (blue trace) and average (black trace) detector. Both the lower and higher band-edge values, measured with the standard 1 MHz bandwidth and a peak and average detector show compliance with the required limits in the adjacent restricted bands.

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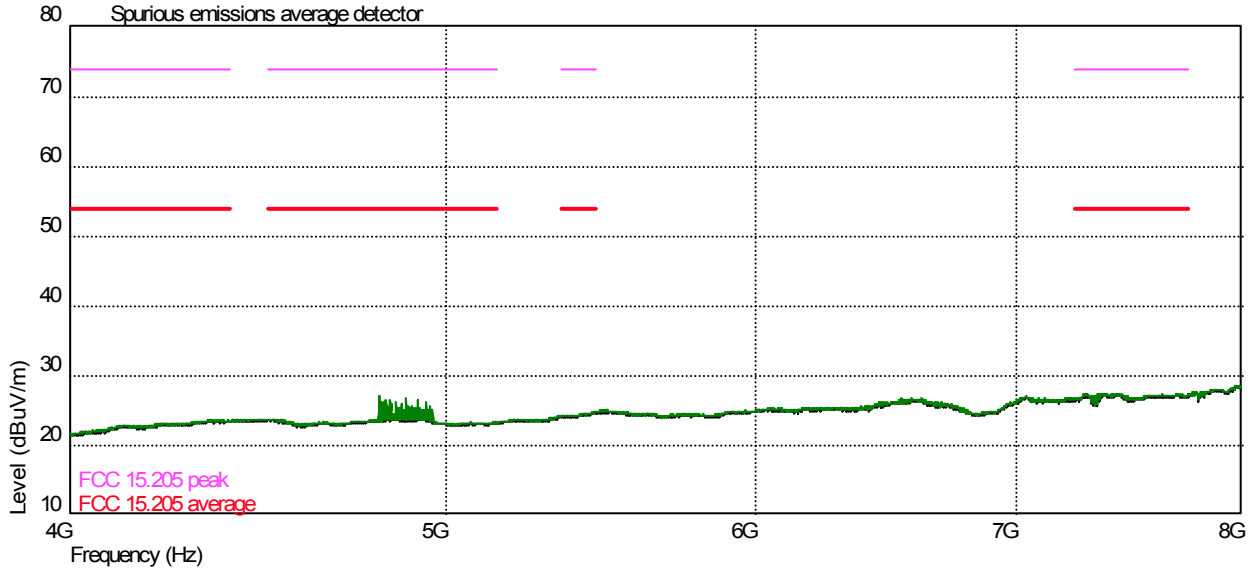
FCC ID: A94Z5GBT

IC: 3232A-Z5GBT

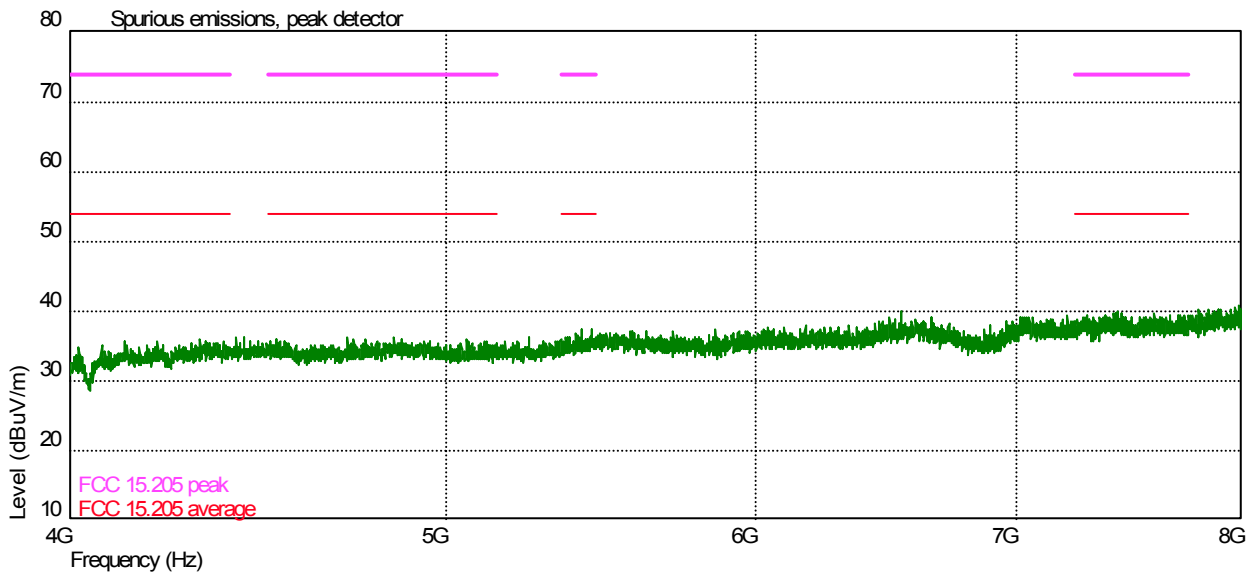
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Frequency range 4 – 8 GHz

Average detector



Peak
detecto



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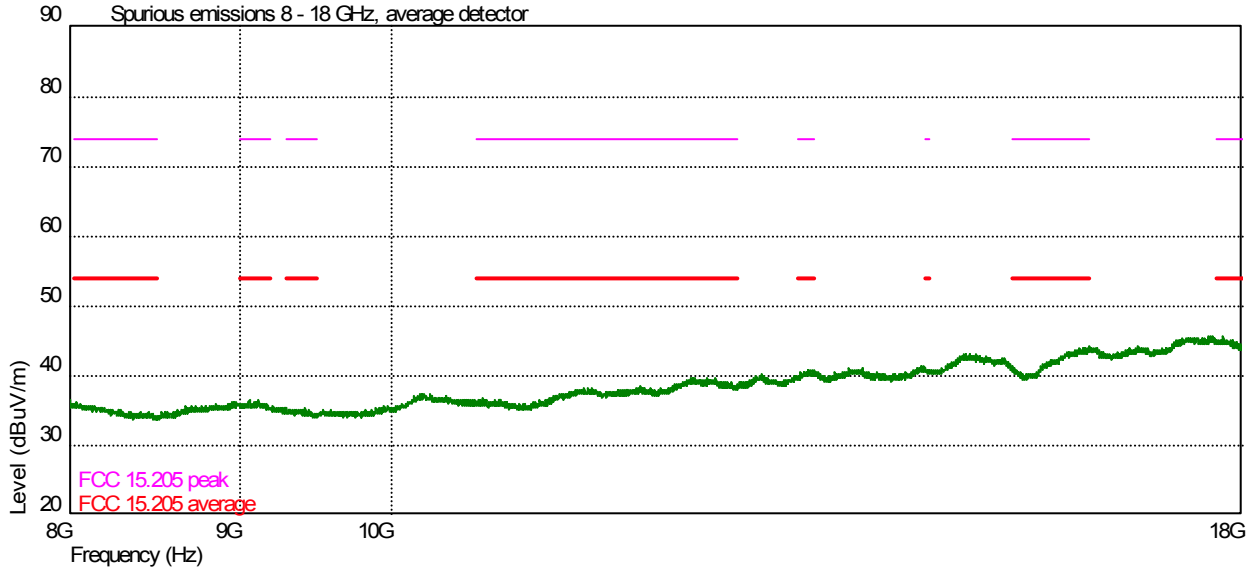
FCC ID: A94Z5GBT

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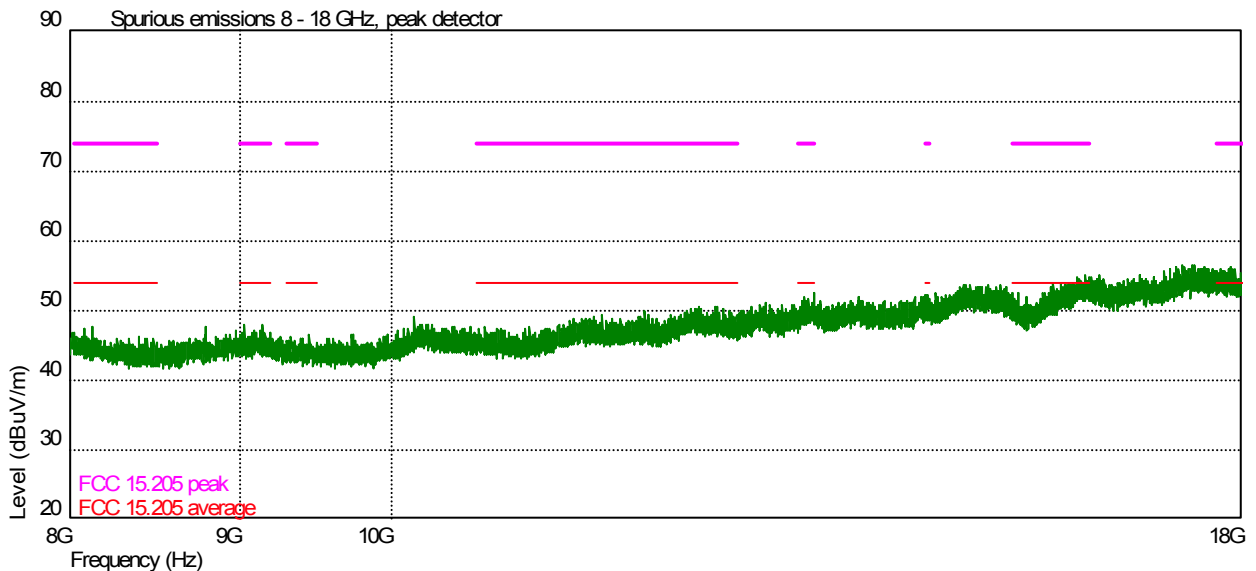
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Frequency range 8 – 18 GHz

Average detector



Peak detector



Measurement from 18 – 25 GHz showed no points above the instrumentation noise floor. The noise floor is > 10 dB below the limit.

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Equipment Type	Manufacturer	Model	Serial or other ID	Service date	
				Last	Due
Receiver	Rohde & Schwarz	ESU40	TN1663	7/29/2009	7/29/2010
Antenna 30M – 6G	Sunol	JB6	TN1541	8/6/2009	8/6/2010
Antenna 4 – 8G	AR	AT4003	TN727	11/24/2008	11/24/2011
Antenna 8 – 18G	AR	AT4004	TN728	11/24/2008	11/24/2011
Antenna 18 – 26.5G	ETS	3160-09	TN1307	2/18/2008	2/18/2010
20 GHz Pre-amp	MITEQ	AFS4-00102000-30-10P-4	TN1672	4/27/2009	4/27/2010
40 GHz pre-amp	MITEQ	JS4018004000-30-8P-A1	TN1757	Verify before use	
Antenna cable 18GHz	Rohde & Schwarz	HFE160D	TN1692	4/27/2009	4/27/2010
40 GHz cable	-	-	TN1277	Verify before use	
Comm. tester	Rohde & Schwarz	CMU200	TN1381	4/27/2009	4/27/2010

Date of test:	Aug 13, 2009	Test location:	Maxwell house
EUT serial:	53AE	Tested by:	Peter Boers
Test result:	Pass		

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6.5. Transmitter Conducted spurious emissions

6.5.1. Requirements

FCC part 15.209(a), part 15.247(d), RSS-GEN section 7.2.3 and RSS-210 section 2.2

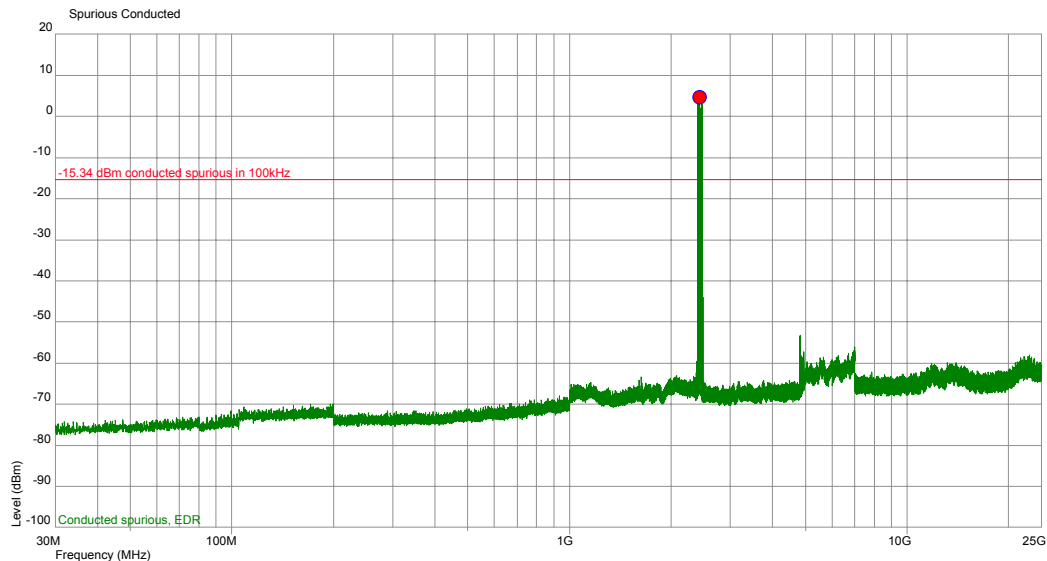
In any 100kHz BW, the spurious emissions shall be attenuated at least 20dB below the level of the wanted signal.

6.5.2. Test setup details

The EUT is connected to the Spectrum analyzer with a high frequency cable; the cable loss factors are incorporated in the transducer settings for the spectrum analyzer. The EUT set to normal hopping sequence. Measurements are made both in basic mode modulation and in EDR modulation with a duty cycle of 10% (worst case for a Bluetooth data sink)

6.5.3. Test data

EDR modulation (3-DH5), maximum in-band value 4.66 dBm



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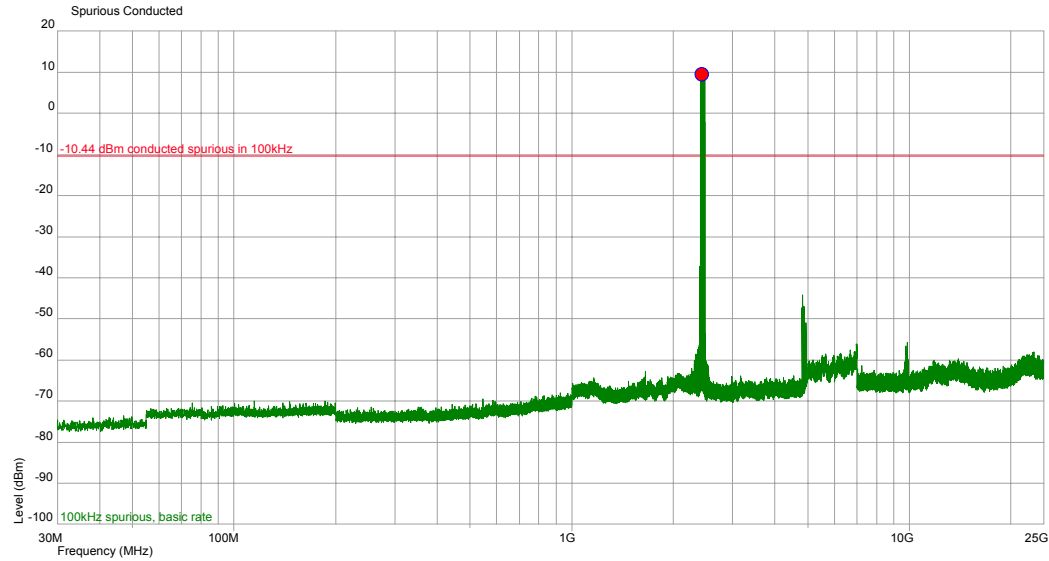


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Basic rate modulation (DH5), maximum in-band value 9.56 dBm



6.5.4. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service date	
				Last	Due
Spectrum analyzer	Rohde & Schwarz	ESIB40	TN1560	3/3/2009	3/3/2010
BT controller	Rohde & Schwarz	CBT	TN1758	5/15/2009	5/15/2010

6.5.5. Test information

Date of test:	June 1, 2009	Test location:	TX test bench
EUT serial:	58AE	Tested by:	Peter Boers
Test result:	Pass		

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6.6. Receiver Conducted Spurious emissions

6.6.1. Requirements

RSS-GEN section 6(b)

Spurious signals at the antenna terminals shall be limited to 2nW per 4 kHz BW in the frequency range of 30 – 1000 MHz and 5nW above 1 GHz.

Measurements shall be made from 30MHz to 3 times the highest tunable or local oscillator frequency without exceeding 40GHz.

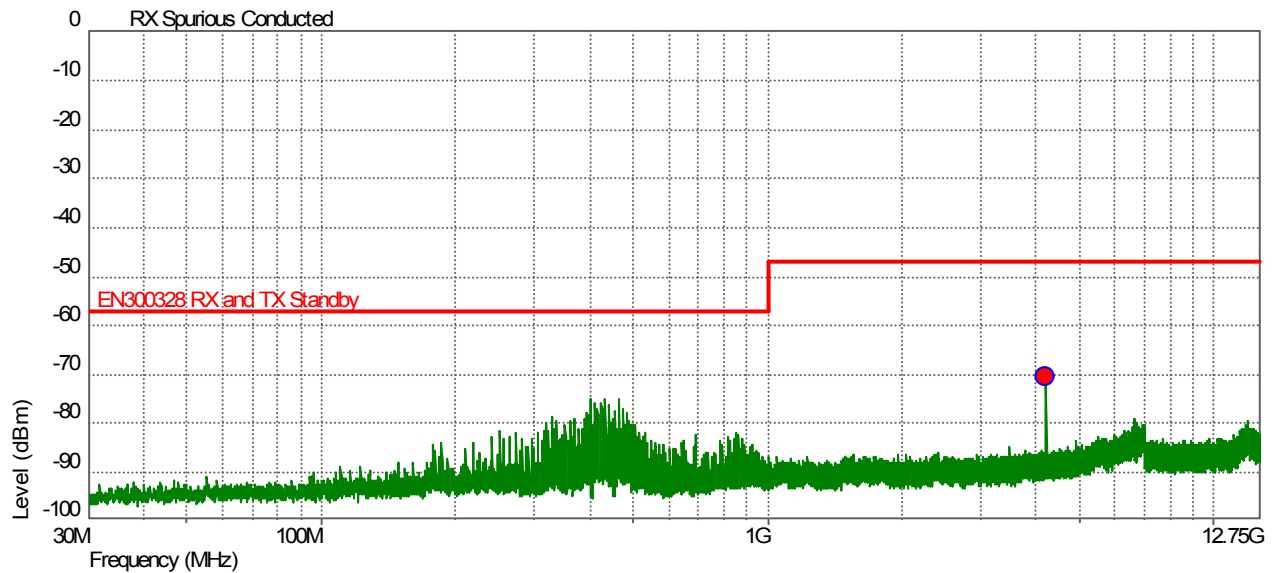
6.6.2. Test setup details

The conducted test setup is identical to the test setup under 6.4.

Measurements are made with a RBW of 100kHz (covering the 4kHz measurement BW requirement) and up to 12.75 GHz (more than 3 times the local oscillator and highest tunable frequency) with a peak detector.

The EUT is programmed to receive-only mode in the middle of the band.

6.6.3. Test data



Max spurious -70.4 dBm@ 4190.3 MHz

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6.6.4. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service date	
				Last	Due
Spectrum analyzer	Rohde & Schwarz	ESIB40	TN1560	3/3/2009	3/3/2010
40GHz cable			TN1277	Verify before use	

6.6.5. Test information

Date of test:	7/24/2009	Test Location:	TX test bench
EUT serial:	58AE	Tested by:	Peter Boers
Test result:	Pass		

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6.7. Conducted emissions.

6.7.1. Requirements

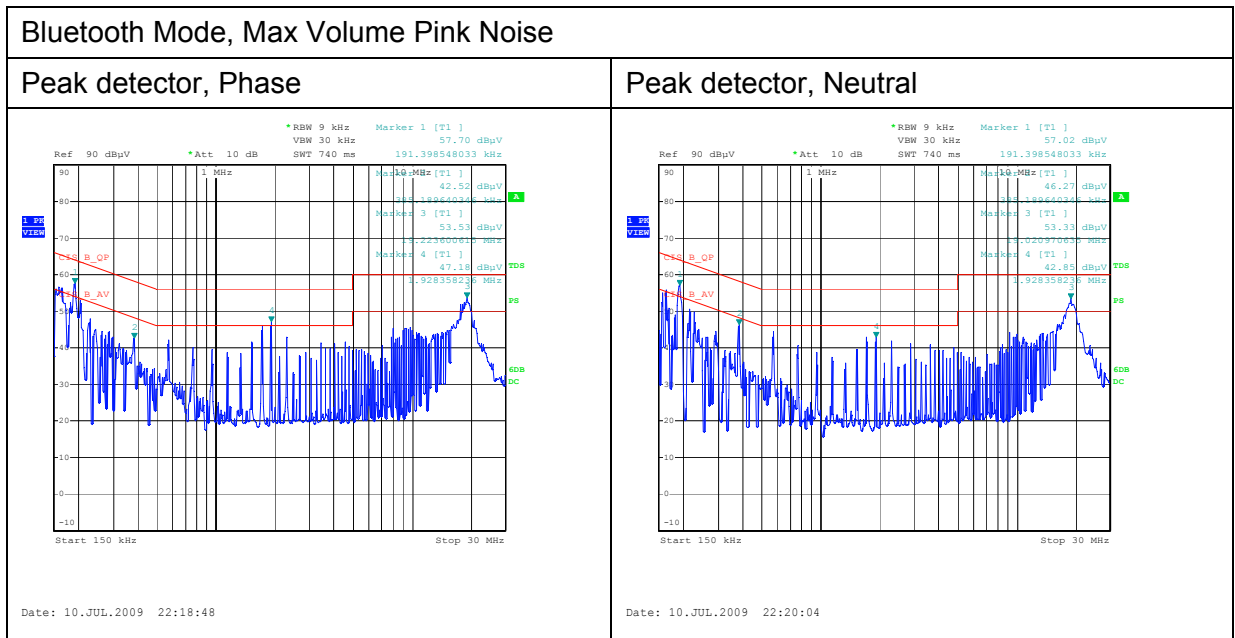
47CFR15.207, 15.107 and RSS-GEN Section 7.2.2

Frequency MHz	Limits dB(μV)	
	Quasi-peak	Average
0.15 - 0.5	66-56	56-46
0.5 - 1.6	56	46
1.6 - 30	60	50

6.7.2. Test setup details

Conducted emissions are measured on the host unit which provides power to the Bluetooth dock. The test setup conforms to ANSI C63.4 requirements; a pink-noise audio stream is provided over the Bluetooth link and adjusted in volume for the worst case emissions profile. Measurements are made on the Phase and Neutral conductor of the host unit.

6.7.3. Test data



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Frequency MHz	Measured		Limit		Margin		Comments
	dB μ V QP	dB μ V av	dB μ V QP	dB μ V av	dB QP	dB avg	
0.1920	55.00	47.60	63.9	53.9	8.9	6.3	Neutral
0.3840	43.40	41.50	58.2	48.2	14.8	6.7	Neutral
1.9210	42.40	39.00	56.0	46.0	13.6	7.0	Neutral
19.2040	50.00	41.40	60.0	50.0	10.0	8.6	Neutral
0.1920	53.40	43.60	63.9	53.9	10.5	10.3	Phase
0.3840	40.40	38.50	58.2	48.2	17.8	9.7	Phase
1.9210	46.70	42.90	56.0	46.0	9.3	3.1	Phase
19.2040	49.90	41.60	60.0	50.0	10.1	8.4	Phase

6.7.4. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service	
				Last	due date
LISN	EMCO	3810/2	TN600	2/26/2009	2/26/2010
Receiver	Rohde & Schwarz	ESCI	TN1420	6/2/2009	6/2/2010
Transient Limiter	HP	11947A	TN57	11/5/2007	11/5/2009

6.7.5. Test results

Date of test:	10-July-09	Test Location:	Henry room
EUT serial:	20	Tested by:	A. Paradis
Test result:	Pass		

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6.8. Radiated emissions 30 MHz – 1 GHz

6.8.1. Requirements

FCC rules part 15.109 (g), 15.209 and CAN-CSA-CISPR22 class B

Frequency	Limit in dB μ V/m @3m
MHz	Quasi-peak
30 – 230	40
230 - 1000	47

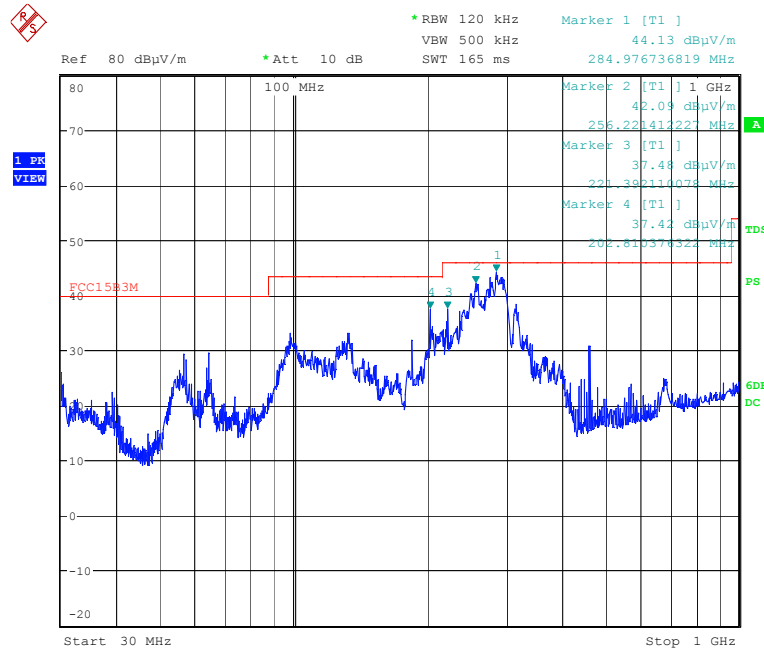
6.8.2. Test setup details

The EUT was placed on a 80 cm high table and configured for worst case emissions based on previous testing. Data represents the worst case operating mode with the audio stream based on pink noise. Most of the data is associated with the FCC part 15.B attributes of the product.

The measurement antenna was adjusted in height between 1 and 4 meters, the polarization changed from H to V and the table was rotated around its axis over 360 degrees in order to maximize the received signal.

6.8.3. Test data

Test mode: Ipod, max volume pink noise



Date: 10.JUL.2009 19:13:20

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FCC ID: A94Z5GBT

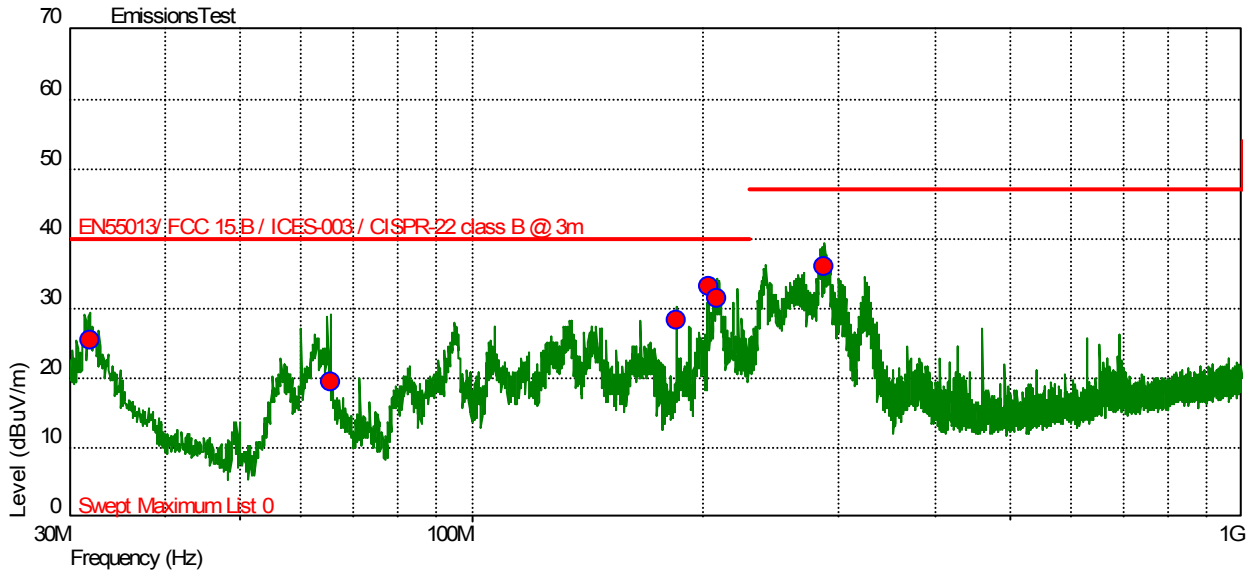
IC: 3232A-Z5GBT

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Manual QP measurements are made for the highest emissions relative to the limit line with the following results:

Frequency (MHz)	Level (dBμV/m)	Height (m)	Polar	Angle (Deg)	Limit (dBμV/m)	Margin (dB)	Comment
202.770	35.50	1	H	0	43.5	8.0	QP
278.350	37.20	1	H	30	46.0	8.8	QP

Test mode: Bluetooth dock



Manual QP measurements are made for the 6 highest emissions relative to the limit line with the following results:

Frequency (MHz)	Level (dBμV/m)	Height (m)	Polar	Angle (Deg)	Limit (dBμV/m)	Margin (dB)	Comment
31.9	25.60	1.00		30	40	14.4	QP
65.5	19.50	1.00		300	40	21.5	QP
184.3	28.20	1.00		330	40	11.8	QP
202.75	33.10	1.50	--	0	40	7.9	QP
207.85	31.50	1.50	--	0	40	8.5	QP
287.15	36.10	1.00		300	47	10.9	QP

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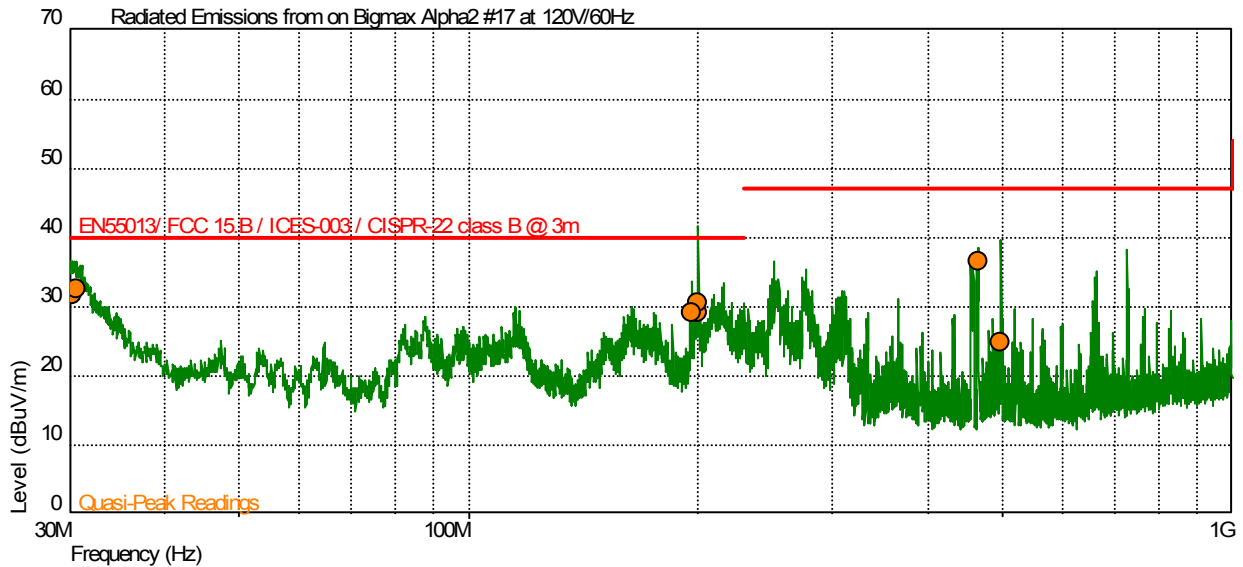


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Test mode: PC peripheral



Quasi-Peak Measurement

Frequency (MHz)	Level (dBuV/m)	Height (m)	Polar	Angle (Deg)	Limit (dBuV/m)	Margin (dB)	Comment
30.26	31.8	2.00	--	299.00	40	8.2	
30.7	32.7	1.00		300.00	40	7.3	
196.55	29.1	1.00	--	329.00	40	10.9	
199.8	29.2	2.00	--	299.00	40	10.8	
200.0	30.5	2.00	--	299.00	40	9.5	
466.25	36.7	1.50		359.00	47	10.3	
496.85	25.0	1.50		359.00	47	22.0	

6.8.3.1. Test Equipment

Equipment Type	Manufacturer	Model	Serial or other ID	Service	
				last	due
Antenna	Sunol Sciences	JB6	TN1541	6/18/2009	7/18/2009
Receiver	Rohde & Schwarz	ESU40	TN1663	5/30/2008	6/30/2009
Pre-amp	Rohde & Schwarz	TS-PR8	TN1669	3/5/2009	3/5/2010

6.8.4. Test information

Date of test:	Jul 10 & 23, Aug 6, 2009	Test location :	DCE - Maxwell House
EUT serial:	17	Tested by:	A. Paradis / C.Bell
Test result:	Pass		

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6.9. RF exposure estimate

Although the device is a desktop unit in the mobile device exposure category ($d > 20\text{cm}$), the following calculation uses portable exposure low threshold limit for a more conservative estimate.

Based on the measured power output (see section 6.2)

Maximum peak conducted output	11.2 dBm (13.2mW)
Maximum antenna gain*	- 2.3 dBi
EIRP	8.9 dBm (7.8 mW) eirp

* Antenna gain is determined by measuring EIRP according to EN300328 and subtracting conducted output. Antenna gain and output power are not necessarily flat with frequency. For the purposes of this estimate the highest measured output power is combined with the highest measured antenna gain irrespective of frequency,

The device operates as a Bluetooth “data sink” with a duty cycle that does not exceed 5%. For a worst case estimate a 10% duty cycle is assumed in the calculation.

Source based time averaged conducted output power	$0.1 \times 13.2 = 1.32 \text{ mW}$
Source based time averaged EIRP	$0.1 \times 7.8 = 0.78 \text{ mW}$

The low threshold for SAR exemption is $60/f(\text{GHz}) = 60/2.441 = 24.6\text{mW}$

Since both conducted output power and E.I.R.P. (source based time averaged) are below the low threshold for SAR exemption, the device complies with FCC RF radiation exposure limits for general population as a portable device.

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