

SECTION 5: Carrier frequency separation

Test procedure

The carrier frequency separation was measured with a spectrum analyzer connected to the antenna port.

Summary of the test results: Pass
Refer to APPENDIX 1

SECTION 6: 20dB bandwidth & Occupied bandwidth (99%)

Test procedure

The bandwidth was measured with a spectrum analyzer connected to the antenna port.

Summary of the test results: Pass
Refer to APPENDIX 1

SECTION 7: Number of hopping frequency

Test procedure

The number of hopping frequency was measured with a spectrum analyzer connected to the antenna port.

Summary of the test results: Pass
Refer to APPENDIX 1

SECTION 8: Dwell time

Test procedure

The dwell time was measured with a spectrum analyzer connected to the antenna port.

Summary of the test results: Pass
Refer to APPENDIX 1

SECTION 9: Maximum peak output power

Test procedure

The maximum peak output power was measured with a power meter connected to the antenna port.

Summary of the test results: Pass
Refer to APPENDIX 1

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SECTION 10: Radiated emission

10.1 Operating environment

Test place : See test data (APPENDIX 1)
Temperature : See test data (APPENDIX 1)
Humidity : See test data (APPENDIX 1)

10.2 Test configuration

EUT was placed on a urethane platform of nominal size, 0.5m by 0.5m, raised 0.8m above the conducting ground plane. Photographs of the set up are shown in APPENDIX 3.

10.3 Test conditions

Frequency range : 30MHz to 25GHz
Test distance : 3m (below 15GHz) / 1m (above 15GHz)
EUT position : Table top

10.4 Test procedure

The Radiated Electric Field Strength intensity has been measured on a semi-anechoic chamber with a ground plane and at a distance of 3m (below 15GHz) / 1m (above 15GHz) (Refer to Figure 1). Measurements were performed with quasi-peak, peak and average detector. The measuring antenna height was varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity. The measurements were performed for both vertical and horizontal antenna polarization.

The radiated emission measurements were made with the following detection of the test receiver.

Frequency	30-1000MHz	1-25GHz		20dBc
Detection type	Quasi-Peak	Peak	* Average	Peak
IF Bandwidth	120kHz	RBW: 1MHz VBW: 3MHz	RBW: 1MHz VBW: 10Hz	RBW: 100kHz VBW: 300kHz

* When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold. Although 00-705 accepts VBW=10Hz for AV measurements, confirmed that superfluous smoothing was not performed.

The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

Worst position:

Frequency range		Below 1GHz	Above 1GHz	Carrier
EUT (Module & Antenna)	Horizontal	Y	Z	X
	Vertical	Y	Y	Z

* The definition of the axis was listed in a 'Pre-check of the worst position' in APPENDIX 3.

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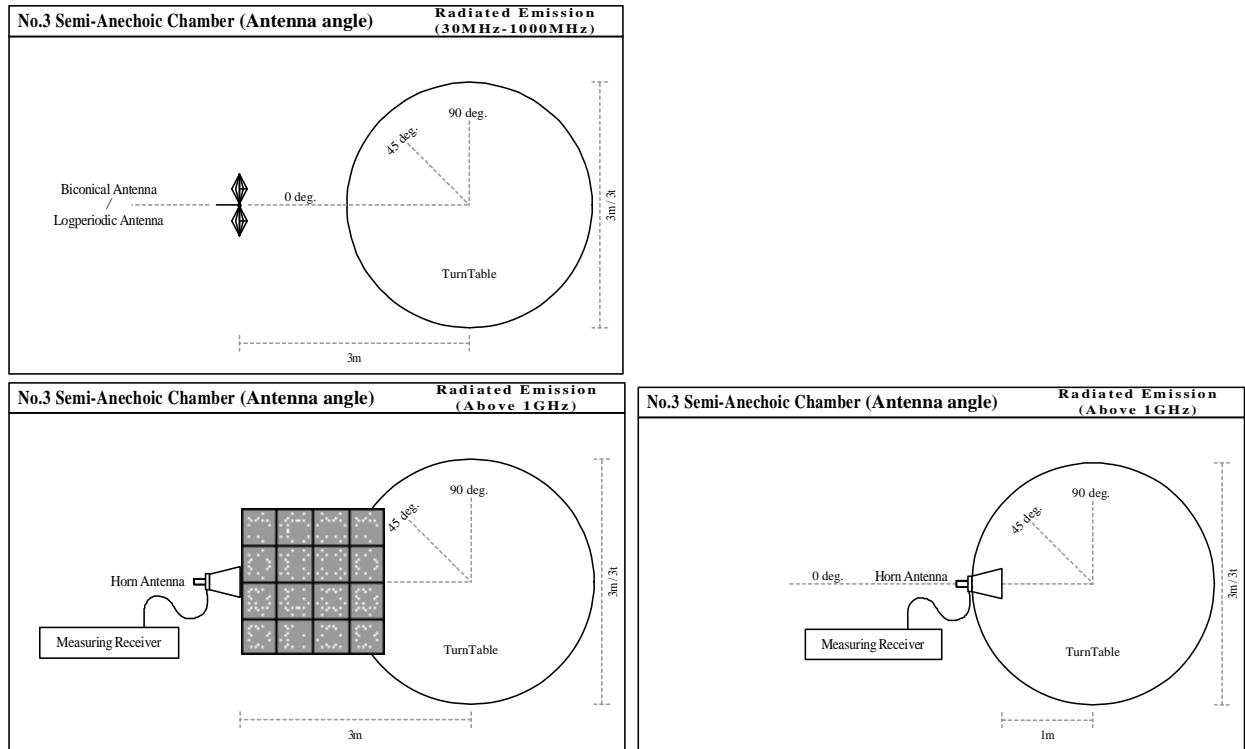
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Figure 1. Antenna angle



10.5 Band edge

Band edge level at 2390MHz and 2483.5MHz is below the limits of FCC 15.209 and band edge level at 2400MHz is below the 20dBc. Refer to the data.

10.6 Results

Summary of the test results : Pass *No noise was detected above the 5th order harmonics.
Refer to APPENDIX 1

SECTION 11: Spurious emissions (Antenna port conducted)

Test procedure

The Out of Band Emissions was measured with a spectrum analyzer connected to the antenna port. In any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement. In the frequency range below 30MHz, RBW was narrowed to separate the noise contents. Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart. (9kHz-150kHz:RBW=200Hz, 150kHz-30MHz:RBW=10kHz)

Summary of the test results: Pass
Refer to APPENDIX 1

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Contents of APPENDIXES

APPENDIX 1: Data of Radio tests

20dB bandwidth and Carrier frequency separation
Number of hopping frequency
Dwell time
Maximum peak output power
Radiated emission
Spurious emission (Antenna port conducted)
Occupied bandwidth

APPENDIX 2: Test instruments

Test instruments

APPENDIX 3: Photographs of test setup

Radiated emission
Pre-check of worst position
Antenna type

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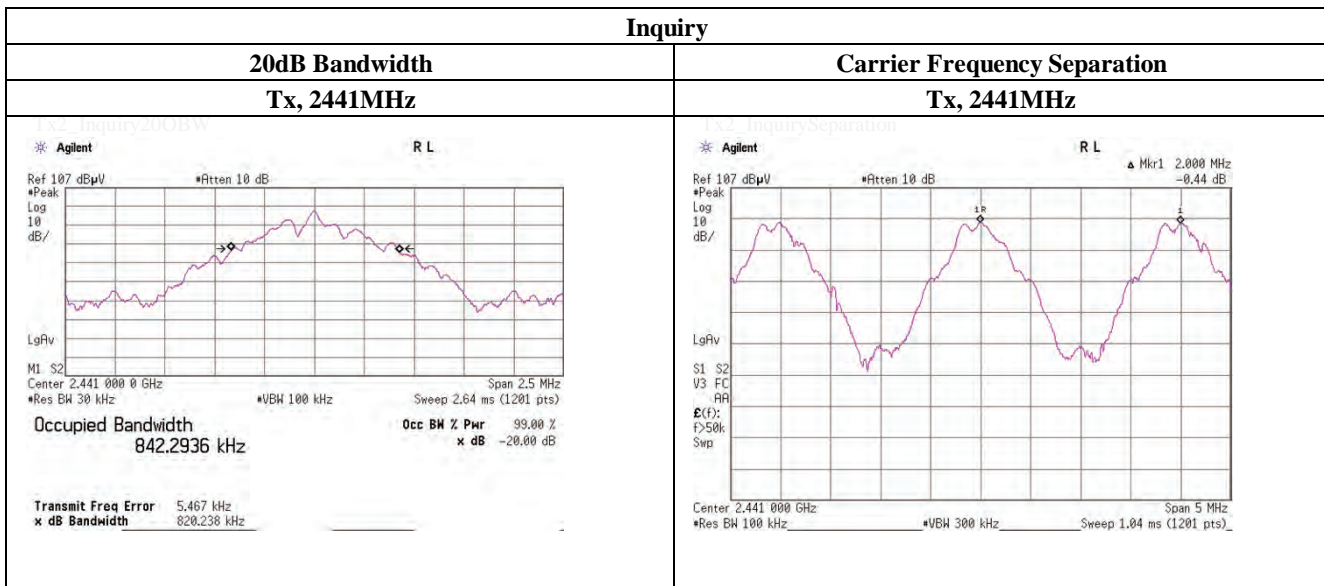
APPENDIX 1: Data of Radio tests

20dB Bandwidth and Carrier Frequency Separation

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date June 25, 2012
 Temperature / Humidity 24 deg.C , 52 %RH
 Engineer Makoto Hosaka
 Mode Tx, Bluetooth, BDR, PRBS9

Mode	Freq. [MHz]	20dB Bandwidth [MHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency Separation [MHz]
DH5	2402.0	0.956	1.000	>= 0.637
DH5	2441.0	0.948	1.000	>= 0.632
DH5	2480.0	0.954	1.000	>= 0.636
Inquiry	2441.0	0.820	2.000	>= 0.547

Limit: Two-thirds of 20dB Bandwidth or 25kHz (whichever is greater).
 No limit applies to 20dB Bandwidth.



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20dB Bandwidth and Carrier Frequency Separation

Tx, Bluetooth, BDR, PRBS9

20dB Bandwidth	Carrier Frequency Separation
Tx, 2402MHz	Tx, 2402MHz
<p> Occupied Bandwidth 848.9397 kHz </p> <p> Transmit Freq Error -387.351 Hz </p>	<p> Mkr1 1.000 0 MHz -0.04 dB </p>
Tx, 2441MHz	Tx, 2441MHz
<p> Occupied Bandwidth 845.7884 kHz </p> <p> Transmit Freq Error 400.322 Hz </p>	<p> Mkr1 1.000 0 MHz 0.02 dB </p>
Tx, 2480MHz	Tx, 2480MHz
<p> Occupied Bandwidth 854.7693 kHz </p> <p> Transmit Freq Error 1.128 kHz </p>	<p> Mkr1 1.000 0 MHz 0.05 dB </p>

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20dB Bandwidth and Carrier Frequency Separation

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date June 25, 2012
 Temperature / Humidity 24 deg.C , 52 %RH
 Engineer Makoto Hosaka
 Mode Tx, Bluetooth, EDR, PRBS9

Mode	Freq. [MHz]	20dB Bandwidth [MHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency Separation [MHz]
3-DH5	2402.0	1.314	1.000	≥ 0.876
3-DH5	2441.0	1.315	1.000	≥ 0.877
3-DH5	2480.0	1.316	1.000	≥ 0.877

Limit: Two-thirds of 20dB Bandwidth or 25kHz (whichever is greater).

No limit applies to 20dB Bandwidth.

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20dB Bandwidth and Carrier Frequency Separation

Tx, Bluetooth, EDR, PRBS9

20dB Bandwidth	Carrier Frequency Separation
Tx, 2402MHz	Tx, 2402MHz
<p> Occupied Bandwidth 1.2033 MHz </p> <p> Transmit Freq Error -484.338 Hz x dB Bandwidth 1.314 MHz </p>	<p> Carrier Frequency Separation Mkr1 1.0000 MHz 0.07 dB </p>
Tx, 2441MHz	Tx, 2441MHz
<p> Occupied Bandwidth 1.2244 MHz </p> <p> Transmit Freq Error -5.343 kHz x dB Bandwidth 1.315 MHz </p>	<p> Carrier Frequency Separation Mkr1 1.0000 MHz 0.00 dB </p>
Tx, 2480MHz	Tx, 2480MHz
<p> Occupied Bandwidth 1.2011 MHz </p> <p> Transmit Freq Error -518.298 Hz x dB Bandwidth 1.316 MHz </p>	<p> Carrier Frequency Separation Mkr1 1.0000 MHz -0.04 dB </p>

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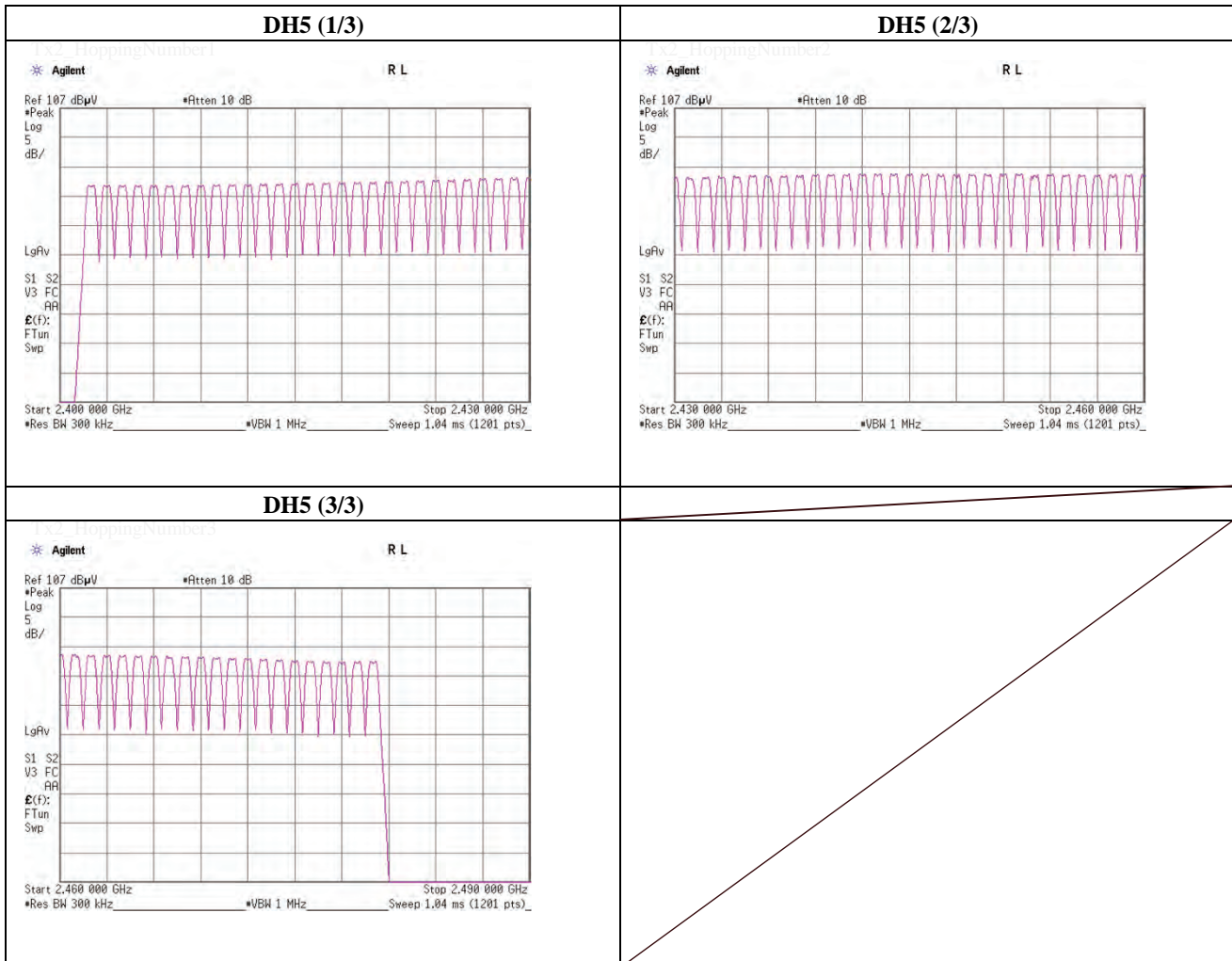
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Number of Hopping Frequency

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	June 25, 2012	
Temperature / Humidity	24 deg.C , 52 %RH	
Engineer	Makoto Hosaka	
Mode	Tx, Bluetooth, BDR, PRBS9	

Mode	Number of Channel [times]	Limit [times]
DH5	79	>= 15

Test was not performed at AFH mode whose number of hopping channel is 20 channels because this Bluetooth radio is in compliance of Bluetooth Specification 3.0.

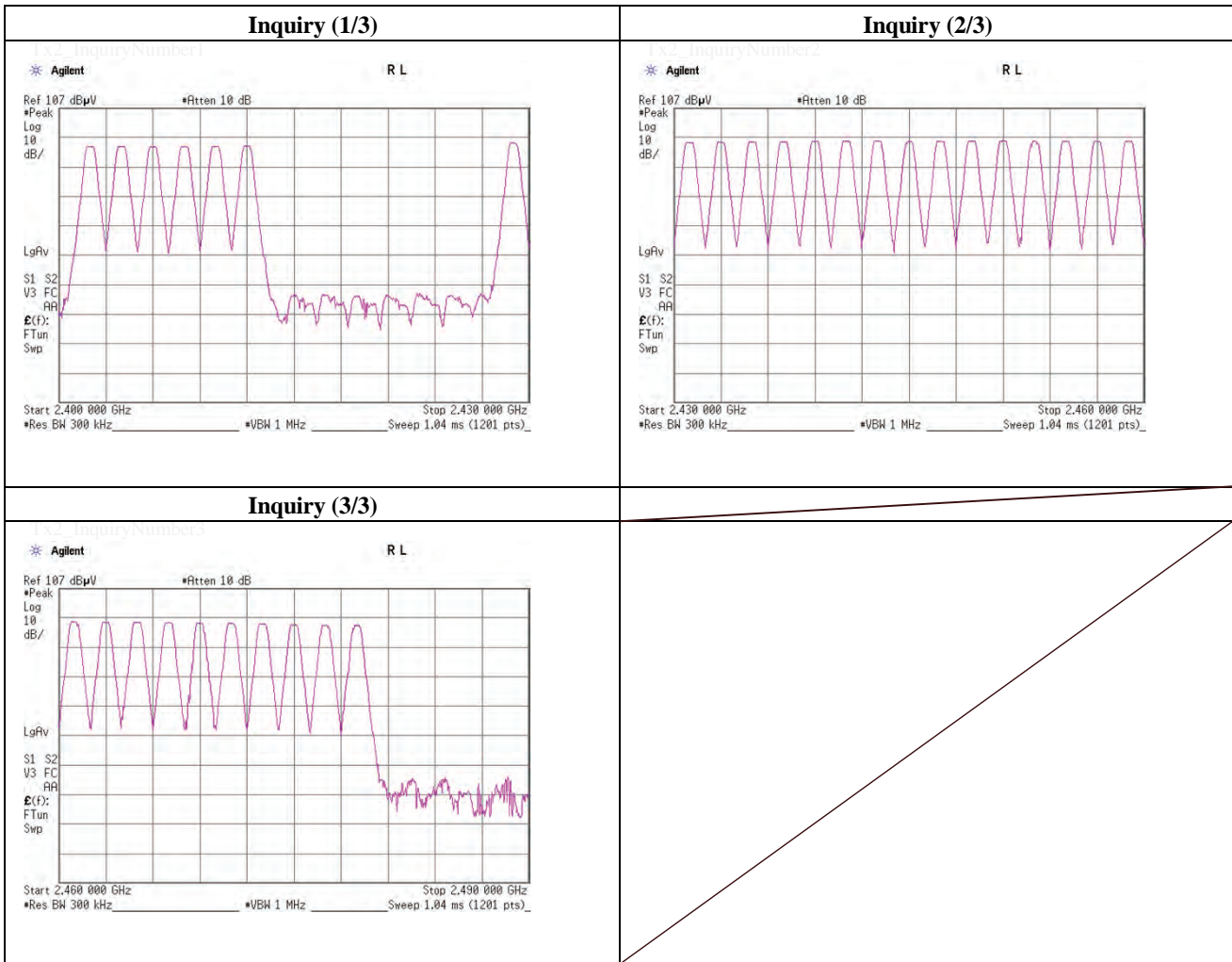


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Number of Hopping Frequency

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	June 25, 2012	
Temperature / Humidity	24 deg.C , 52 %RH	
Engineer	Makoto Hosaka	
Mode	Tx, Bluetooth, Inquiry	

Mode	Number of Channel [times]	Limit [times]
Inquiry	32	>= 15



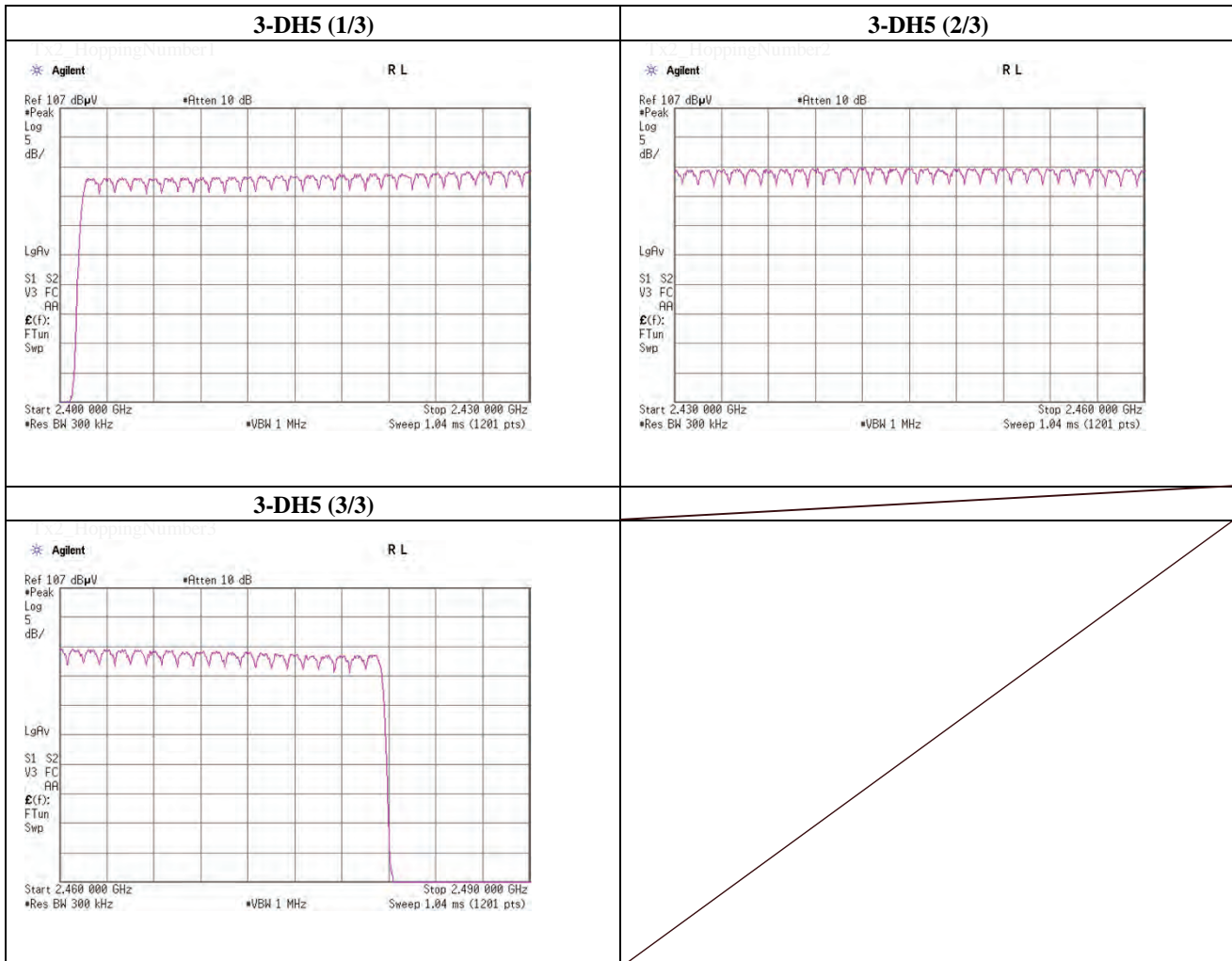
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Number of Hopping Frequency

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	June 25, 2012	
Temperature / Humidity	24 deg.C , 52 %RH	
Engineer	Makoto Hosaka	
Mode	Tx, Bluetooth, EDR, PRBS9	

Mode	Number of Channel [times]	Limit [times]
3-DH5	79	>= 15

Test was not performed at AFH mode whose number of hopping channel is 20 channels because this Bluetooth radio is in compliance of Bluetooth Specification 3.0.



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Dwell Time

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date June 25, 2012
 Temperature / Humidity 24 deg.C , 52 %RH
 Engineer Makoto Hosaka
 Mode Tx, Bluetooth, BDR, PRBS9

Mode	Number of transmission in a 31.6 (79 Hopping x 0.4) / 12.8 (32 Hopping x 0.4) second period	Length of transmission time [msec]	Result [msec]	Limit [msec]
DH1	49.0 / 5.0 sec. x 31.6 sec. = 310 times	0.386	120	400
DH3	25.8 / 5.0 sec. x 31.6 sec. = 164 times	1.643	269	400
DH5	20.8 / 5.0 sec. x 31.6 sec. = 132 times	2.891	382	400
Inquiry	100.0 / 1.0 sec. x 12.8 sec. = 1280 times	0.093	119	400

Sample Calculation

Result = Number of transmission x Length of transmission time

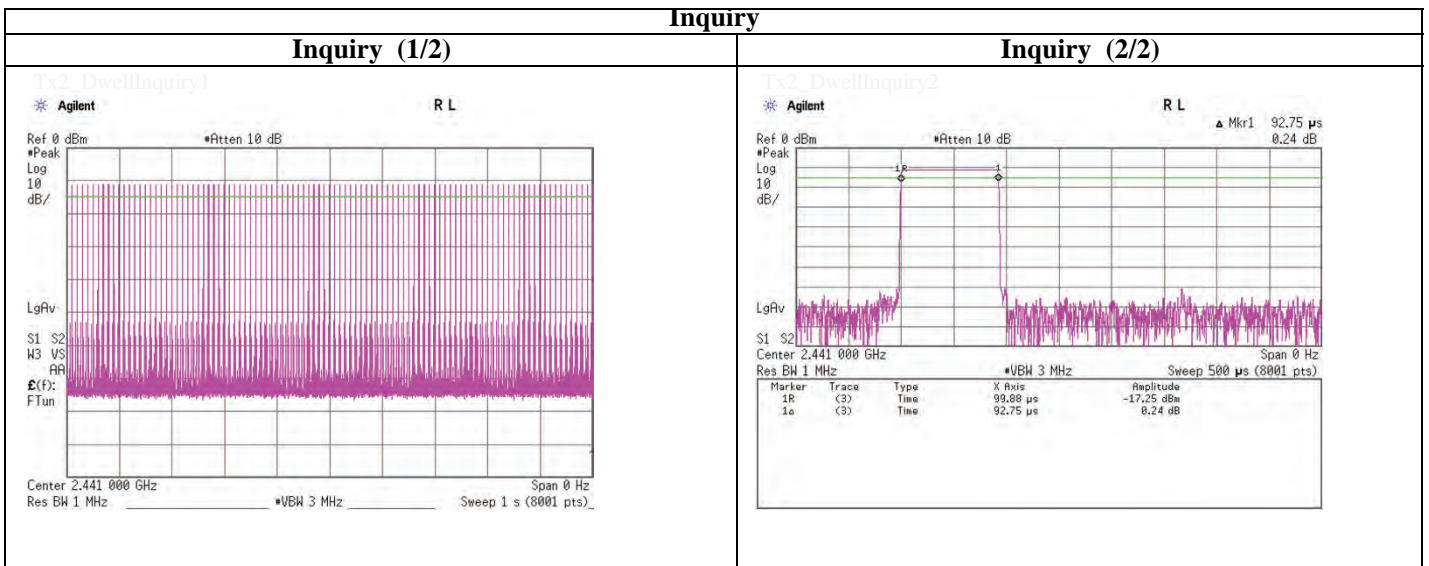
*Average data of 5 tests.(except Inquiry)

Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	48	49	50	48	50	49.0
DH3	24	24	29	28	24	25.8
DH5	22	21	20	20	21	20.8
Inquiry	100	-	-	-	-	100.0

Sample Calculation

Average= Summation(Sampling 1 to 5) / 5

This device complies with the Bluetooth protocol for FHSS operation, employing a pseudo random channel selection and hopping rate to ensure that the occupancy time in $N \times 0.4s$, where N is the number of channels being used in the hopping sequence ($20 \leq N \leq 79$), is always less than 0.4s regardless of packet size (DH1, DH3 or DH5). This is confirmed in the test report for $N=79$.



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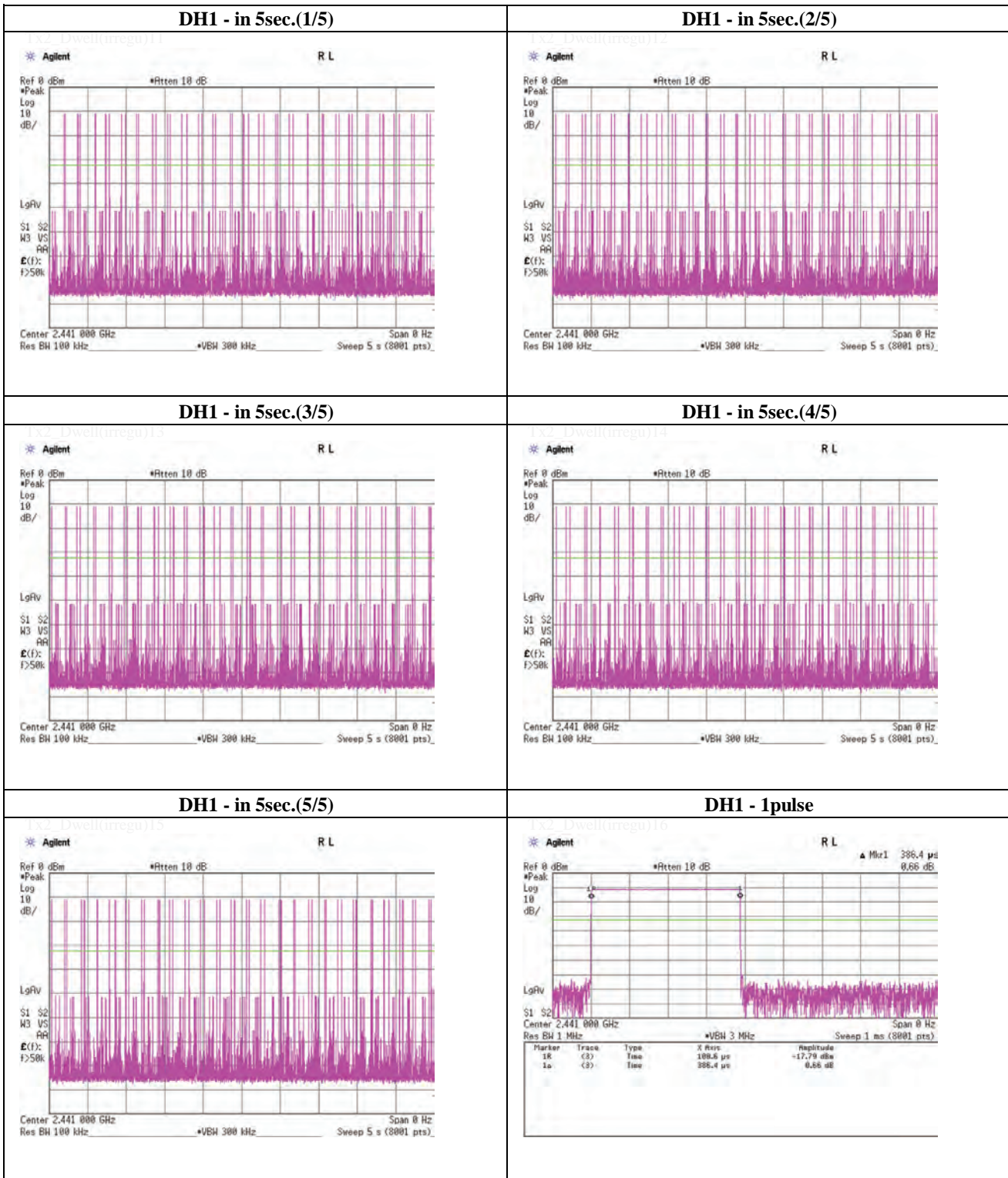
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Dwell time

Tx, Bluetooth, BDR, PRBS9



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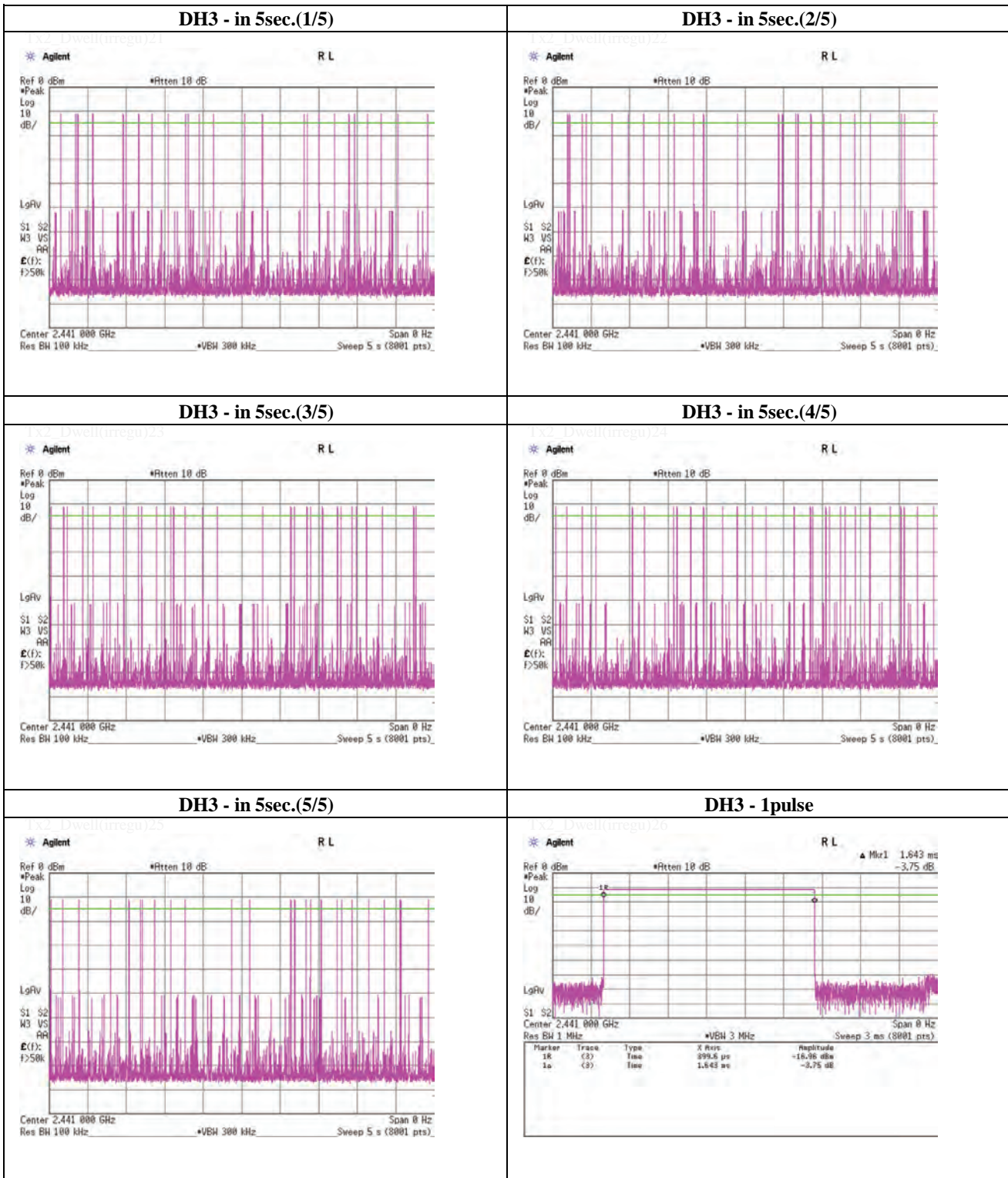
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Dwell time

Tx, Bluetooth, BDR, PRBS9



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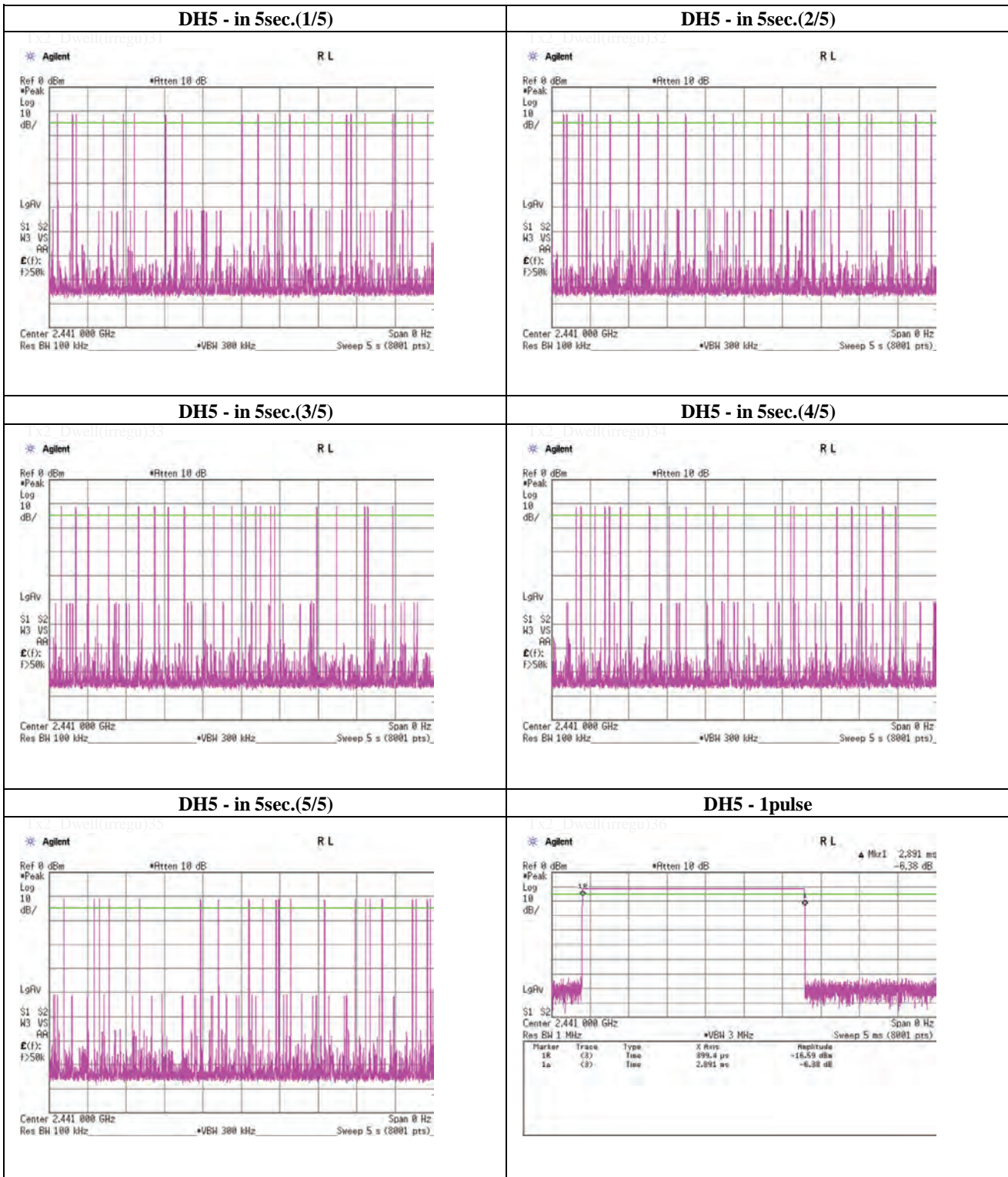
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Dwell time

Tx, Bluetooth, BDR, PRBS9



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Dwell Time

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date June 25, 2012
 Temperature / Humidity 24 deg.C , 52 %RH
 Engineer Makoto Hosaka
 Mode Tx, Bluetooth, EDR, PRBS9

Mode	Number of transmission in a 31.6 (79 Hopping x 0.4)	Length of transmission time [msec]	Result [msec]	Limit [msec]
3-DH1	48.2 / 5.0 sec. x 31.6 sec. = 305 times	0.388	118	400
3-DH3	25.8 / 5.0 sec. x 31.6 sec. = 164 times	1.636	268	400
3-DH5	18.6 / 5.0 sec. x 31.6 sec. = 118 times	2.884	340	400

Sample Calculation

Result = Number of transmission x Length of transmission time

*Average data of 5 tests.(except Inquiry)

Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
3-DH1	48	48	47	49	49	48.2
3-DH3	28	22	26	25	28	25.8
3-DH5	21	14	18	19	21	18.6

Sample Calculation

Average= Summation(Sampling 1 to 5) / 5

This device complies with the Bluetooth protocol for FHSS operation, employing a pseudo random channel selection and hopping rate to ensure that the occupancy time in $N \times 0.4s$, where N is the number of channels being used in the hopping sequence ($20 \leq N \leq 79$), is always less than 0.4s regardless of packet size (3DH1, 3DH3 or 3DH5). This is confirmed in the test report for N=79.

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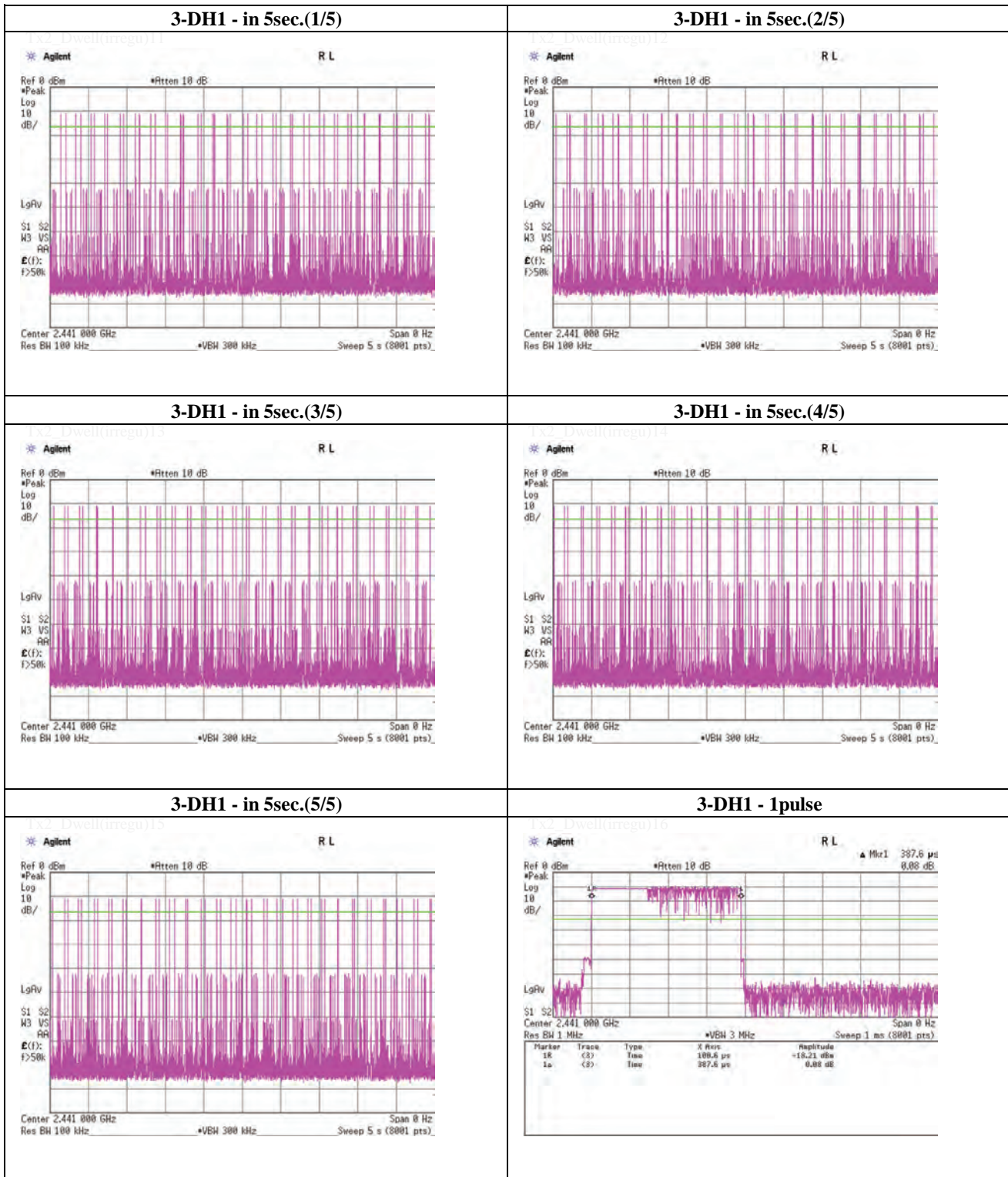
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Dwell time

Tx, Bluetooth, EDR, PRBS9



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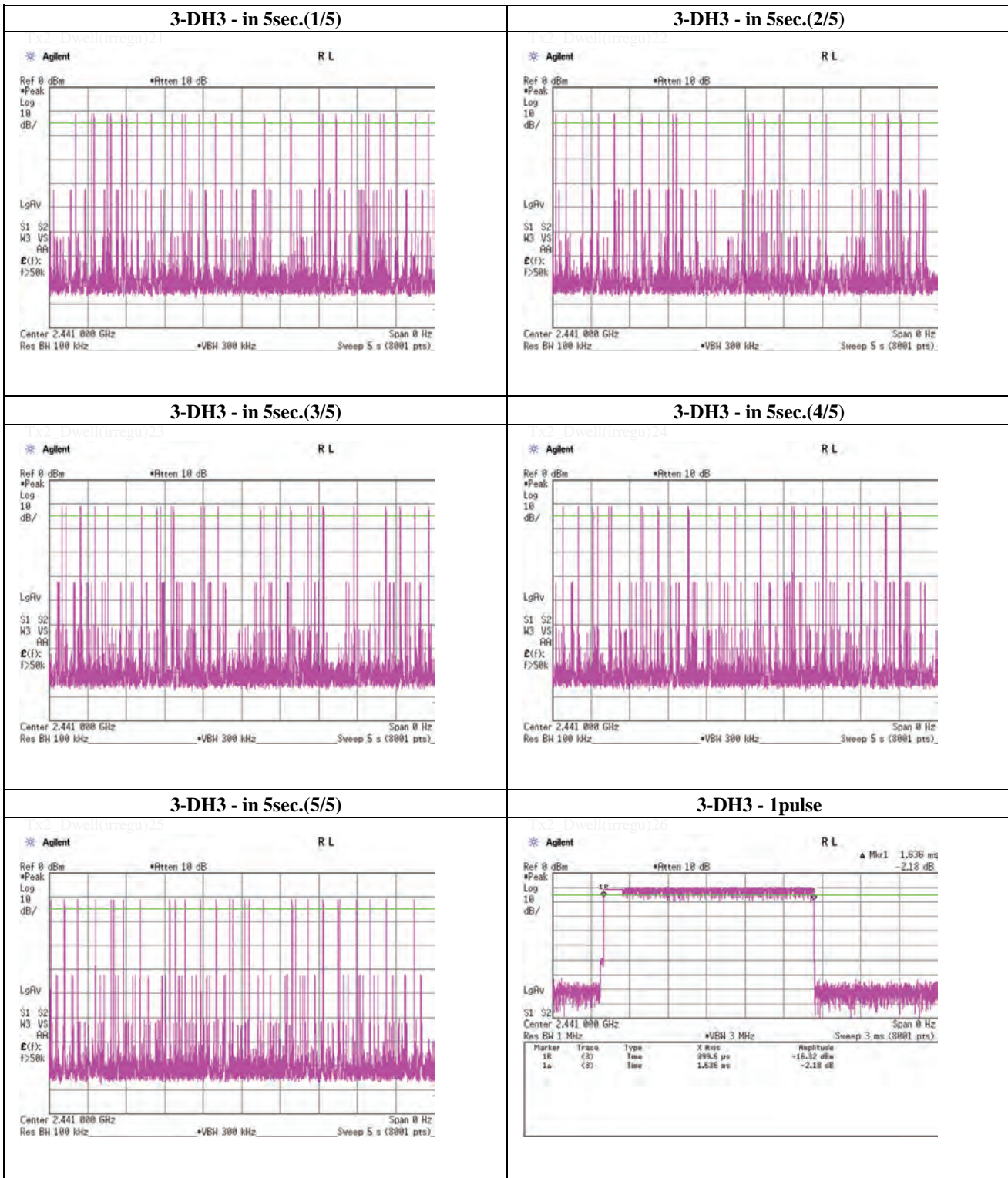
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Dwell time

Tx, Bluetooth, EDR, PRBS9



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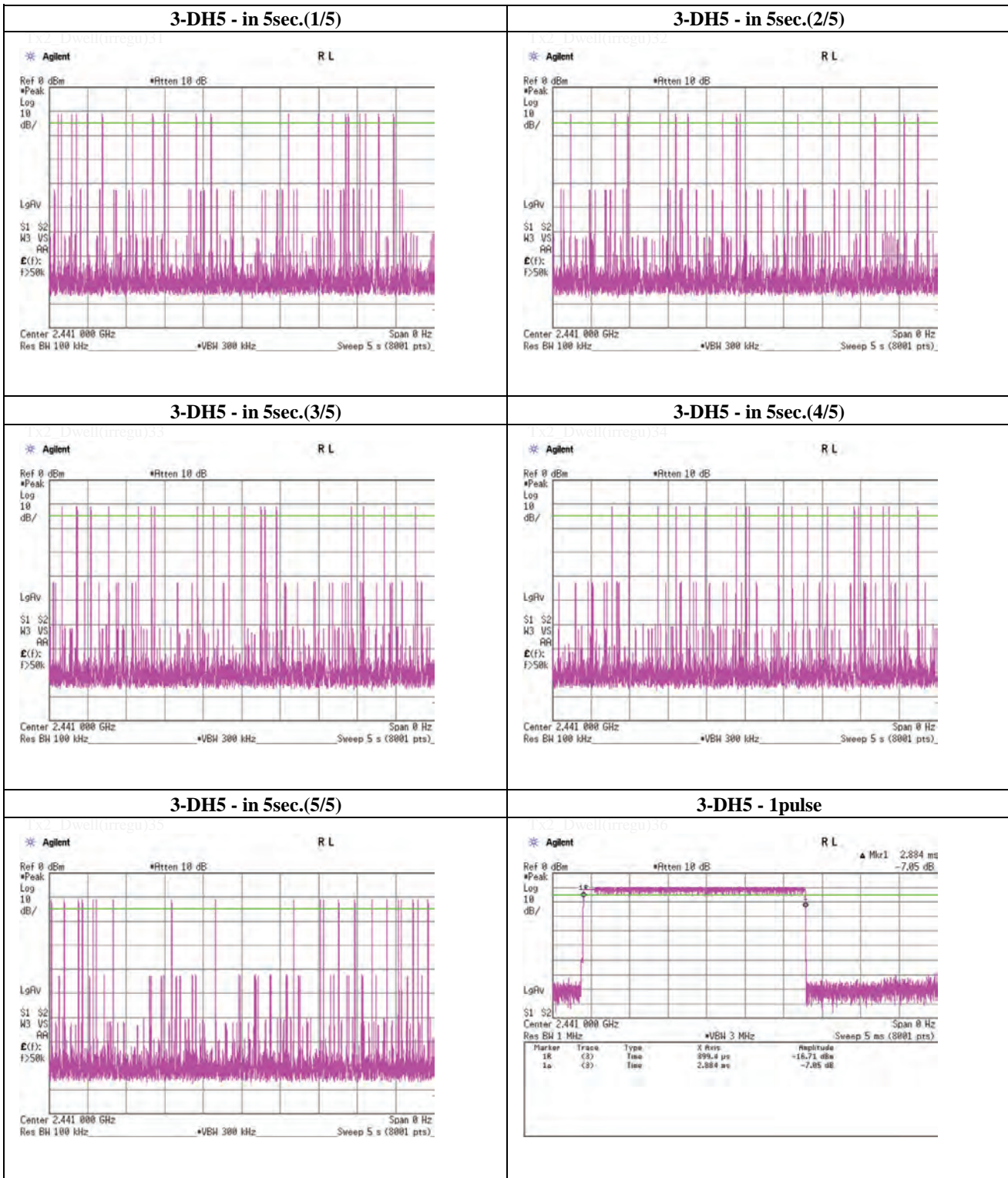
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Dwell time

Tx, Bluetooth, EDR, PRBS9



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Peak Output Power (Conducted)

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date June 25, 2012
 Temperature / Humidity 24 deg.C , 52 %RH
 Engineer Makoto Hosaka
 Mode Tx, Bluetooth

(* P/M: Power Meter with power sensor)

	Freq. [MHz]	P/M (Peak) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
					[dBm]	[mW]	[dBm]	[mW]	
DH5	2402.0	-11.86	1.51	9.97	-0.38	0.92	20.97	125	21.35
DH5	2441.0	-10.07	1.48	9.97	1.38	1.37	20.97	125	19.59
DH5	2480.0	-11.35	1.49	9.97	0.11	1.03	20.97	125	20.86
2-DH5	2402.0	-9.18	1.51	9.97	2.30	1.70	20.97	125	18.67
2-DH5	2441.0	-8.16	1.48	9.97	3.29	2.13	20.97	125	17.68
2-DH5	2480.0	-8.97	1.49	9.97	2.49	1.77	20.97	125	18.48
3-DH5	2402.0	-8.68	1.51	9.97	2.80	1.91	20.97	125	18.17
3-DH5	2441.0	-7.75	1.48	9.97	3.70	2.34	20.97	125	17.27
3-DH5	2480.0	-8.49	1.49	9.97	2.97	1.98	20.97	125	18.00

Sample Calculation:

Result = Reading + Cable Loss + Atten. Loss

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Radiated Emission

Test place UL Japan, Inc. Shonan EMC Lab. No.3 Semi Anechoic Chamber
 Date June 24, 2012 June 26, 2012
 Temperature / Humidity 24 deg.C , 58 %RH 25 deg.C , 59 %RH
 Engineer Makoto Hosaka Makoto Hosaka
 Mode Tx, 2402 MHz
 Tx, Bluetooth, BDR, PRBS9

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	130.001	QP	30.2	13.6	7.5	32.1	19.2	43.5	24.3	152	104	
Hori.	2388.883	PK	50.3	27.2	14.2	41.1	50.6	73.9	23.3	100	39	
Hori.	2390.000	PK	46.6	27.2	14.2	41.1	46.9	73.9	27.0	100	39	
Hori.	4804.000	PK	62.6	31.1	6.8	41.1	59.4	73.9	14.5	100	32	
Hori.	7206.000	PK	54.9	36.5	8.3	41.3	58.4	73.9	15.5	135	330	
Hori.	9608.000	PK	44.3	38.2	9.4	38.8	53.1	73.9	20.8	100	0	
Hori.	12010.000	PK	45.7	39.3	10.7	39.2	56.5	73.9	17.4	100	0	
Vert.	38.233	QP	29.5	14.7	6.6	32.2	18.6	40.0	21.4	100	41	
Vert.	55.061	QP	34.5	9.7	6.8	32.2	18.8	40.0	21.2	100	202	
Vert.	111.600	QP	32.6	11.5	7.3	32.1	19.3	43.5	24.2	100	151	
Vert.	182.001	QP	31.5	15.9	7.8	32.1	23.1	43.5	20.4	100	11	
Vert.	383.311	QP	21.9	16.0	8.9	32.0	14.8	46.0	31.2	100	0	
Vert.	2388.883	PK	49.3	27.2	14.2	41.1	49.6	73.9	24.3	123	119	
Vert.	2390.000	PK	46.4	27.2	14.2	41.1	46.7	73.9	27.2	123	119	
Vert.	4804.000	PK	59.4	31.1	6.8	41.1	56.2	73.9	17.7	127	351	
Vert.	7206.000	PK	53.8	36.5	8.3	41.3	57.3	73.9	16.6	149	320	
Vert.	9608.000	PK	44.6	38.2	9.4	38.8	53.4	73.9	20.5	100	0	
Vert.	12010.000	PK	46.6	39.3	10.7	39.2	57.4	73.9	16.5	100	0	

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2388.883	AV	40.9	27.2	14.2	41.1	-24.8	16.4	53.9	37.5	(AV) VBW:10Hz
Hori.	2390.000	AV	34.3	27.2	14.2	41.1	-24.8	9.8	53.9	44.1	(AV) VBW:10Hz
Hori.	4804.000	AV	58.3	31.1	6.8	41.1	-24.8	30.3	53.9	23.6	(AV) VBW:10Hz
Hori.	7206.000	AV	47.1	36.5	8.3	41.3	-24.8	25.8	53.9	28.1	(AV) VBW:10Hz
Hori.	9608.000	AV	32.9	38.2	9.4	38.8	-24.8	16.9	53.9	37.0	(AV) VBW:10Hz
Hori.	12010.000	AV	33.2	39.3	10.7	39.2	-24.8	19.2	53.9	34.7	(AV) VBW:10Hz
Vert.	2388.883	AV	40.3	27.2	14.2	41.1	-24.8	15.8	53.9	38.1	(AV) VBW:10Hz
Vert.	2390.000	AV	34.3	27.2	14.2	41.1	-24.8	9.8	53.9	44.1	(AV) VBW:10Hz
Vert.	4804.000	AV	54.6	31.1	6.8	41.1	-24.8	26.6	53.9	27.3	(AV) VBW:10Hz
Vert.	7206.000	AV	45.1	36.5	8.3	41.3	-24.8	23.8	53.9	30.1	(AV) VBW:10Hz
Vert.	9608.000	AV	31.8	38.2	9.4	38.8	-24.8	15.8	53.9	38.1	(AV) VBW:10Hz
Vert.	12010.000	AV	33.5	39.3	10.7	39.2	-24.8	19.5	53.9	34.4	(AV) VBW:10Hz

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier) + Dwell time factor (refer to "Dwell time factor Calculation")

*Other frequency noises omitted in this report were not seen or have enough margin (more than 20dB).

*The 10th harmonic was not seen so the result was its base noise level.

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

20dBc Data Sheet (RBW 100kHz, VBW 300kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	91.2	27.3	14.2	41.1	91.6	-	-	Carrier
Hori.	2400.000	PK	38.4	27.3	14.2	41.1	38.8	71.6	32.8	
Vert.	2402.000	PK	90.6	27.3	14.2	41.1	91.0	-	-	Carrier
Vert.	2400.000	PK	38.1	27.3	14.2	41.1	38.5	71.0	32.5	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier)

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Radiated Emission

Test place UL Japan, Inc. Shonan EMC Lab. No.3 Semi Anechoic Chamber
 Date July 3, 2012 June 26, 2012
 Temperature / Humidity 25 deg.C , 62 %RH 25 deg.C , 59 %RH
 Engineer Makoto Hosaka Makoto Hosaka
 Mode Tx, 2441 MHz
 Tx, Bluetooth, BDR, PRBS9

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]		Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	130.023	QP	29.5	13.6	7.5	32.1		18.5	43.5	25.0	214	74	
Hori.	4882.000	PK	71.9	31.2	6.9	40.9		69.1	73.9	4.8	100	24	
Hori.	7323.000	PK	56.2	36.8	8.6	41.4		60.2	73.9	13.7	139	331	
Hori.	9764.000	PK	45.6	38.5	9.5	38.8		54.8	73.9	19.1	100	250	
Hori.	12205.000	PK	47.5	39.3	10.8	39.2		58.4	73.9	15.5	100	289	
Vert.	37.942	QP	28.7	14.8	6.6	32.2		17.9	40.0	22.1	100	144	
Vert.	55.296	QP	35.1	9.6	6.8	32.2		19.3	40.0	20.7	100	113	
Vert.	111.718	QP	32.5	11.5	7.3	32.1		19.2	43.5	24.3	100	138	
Vert.	182.003	QP	31.5	15.9	7.8	32.1		23.1	43.5	20.4	100	127	
Vert.	414.187	QP	21.8	16.6	9.1	32.0		15.5	46.0	30.5	100	292	
Vert.	4882.000	PK	67.6	31.2	6.9	40.9		64.8	73.9	9.1	119	0	
Vert.	7323.000	PK	54.9	36.8	8.6	41.4		58.9	73.9	15.0	116	329	
Vert.	9764.000	PK	45.4	38.5	9.5	38.8		54.6	73.9	19.3	110	17	
Vert.	12205.000	PK	47.5	39.3	10.8	39.2		58.4	73.9	15.5	100	182	

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4882.000	AV	68.3	31.2	6.9	40.9	-24.8	40.7	53.9	13.2	(AV) VBW:10Hz
Hori.	7323.000	AV	48.8	36.8	8.6	41.4	-24.8	28.0	53.9	25.9	(AV) VBW:10Hz
Hori.	9764.000	AV	33.5	38.5	9.5	38.8	-24.8	17.9	53.9	36.0	(AV) VBW:10Hz
Hori.	12205.000	AV	35.2	39.3	10.8	39.2	-24.8	21.3	53.9	32.6	(AV) VBW:10Hz
Vert.	4882.000	AV	63.9	31.2	6.9	40.9	-24.8	36.3	53.9	17.6	(AV) VBW:10Hz
Vert.	7323.000	AV	46.6	36.8	8.6	41.4	-24.8	25.8	53.9	28.1	(AV) VBW:10Hz
Vert.	9764.000	AV	33.0	38.5	9.5	38.8	-24.8	17.4	53.9	36.5	(AV) VBW:10Hz
Vert.	12205.000	AV	35.1	39.3	10.8	39.2	-24.8	21.2	53.9	32.7	(AV) VBW:10Hz

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier) + Dwell time factor (refer to "Dwell time factor Calculation")

*Other frequency noises omitted in this report were not seen or have enough margin (more than 20dB).

*The 10th harmonic was not seen so the result was its base noise level.

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

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Radiated Emission

Test place UL Japan, Inc. Shonan EMC Lab. No.3 Semi Anechoic Chamber
 Date July 3, 2012 June 26, 2012
 Temperature / Humidity 25 deg.C , 62 %RH 25 deg.C , 59 %RH
 Engineer Makoto Hosaka Makoto Hosaka
 Mode Tx, 2480 MHz
 Tx, Bluetooth, BDR, PRBS9

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]		Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	130.028	QP	28.6	13.6	7.5	32.1		17.6	43.5	25.9	245	247	
Hori.	873.509	QP	21.9	22.1	10.6	31.2		23.4	46.0	22.6	150	146	
Hori.	2483.500	PK	47.6	27.5	14.3	41.1		48.3	73.9	25.6	100	350	
Hori.	2493.012	PK	48.1	27.5	14.3	41.1		48.8	73.9	25.1	100	350	
Hori.	4960.000	PK	59.4	31.4	6.9	40.8		56.9	73.9	17.0	100	0	
Hori.	7440.000	PK	55.1	37.0	8.8	41.5		59.4	73.9	14.5	100	0	
Hori.	9920.000	PK	46.6	38.8	9.7	38.8		56.3	73.9	17.6	100	0	
Hori.	12400.000	PK	47.5	39.4	10.8	39.2		58.5	73.9	15.4	100	0	
Vert.	37.963	QP	28.0	14.8	6.6	32.2		17.2	40.0	22.8	100	1	
Vert.	54.738	QP	34.0	9.8	6.8	32.2		18.4	40.0	21.6	100	168	
Vert.	130.003	QP	33.0	13.6	7.5	32.1		22.0	43.5	21.5	100	139	
Vert.	182.014	QP	31.3	15.9	7.8	32.1		22.9	43.5	20.6	100	318	
Vert.	2483.500	PK	47.2	27.5	14.3	41.1		47.9	73.9	26.0	151	136	
Vert.	2493.012	PK	47.6	27.5	14.3	41.1		48.3	73.9	25.6	151	136	
Vert.	4960.000	PK	56.5	31.4	6.9	40.8		54.0	73.9	19.9	121	356	
Vert.	7440.000	PK	54.1	37.0	8.8	41.5		58.4	73.9	15.5	174	318	
Vert.	9920.000	PK	45.8	38.8	9.7	38.8		55.5	73.9	18.4	100	19	
Vert.	12400.000	PK	48.0	39.4	10.8	39.2		59.0	73.9	14.9	100	0	

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	34.7	27.5	14.3	41.1	-24.8	10.6	53.9	43.3	(AV) VBW:10Hz
Hori.	2493.012	AV	37.2	27.5	14.3	41.1	-24.8	13.1	53.9	40.8	(AV) VBW:10Hz
Hori.	4960.000	AV	54.8	31.4	6.9	40.8	-24.8	27.5	53.9	26.4	(AV) VBW:10Hz
Hori.	7440.000	AV	46.7	37.0	8.8	41.5	-24.8	26.2	53.9	27.7	(AV) VBW:10Hz
Hori.	9920.000	AV	33.7	38.8	9.7	38.8	-24.8	18.6	53.9	35.3	(AV) VBW:10Hz
Hori.	12400.000	AV	35.3	39.4	10.8	39.2	-24.8	21.5	53.9	32.4	(AV) VBW:10Hz
Vert.	2483.500	AV	34.6	27.5	14.3	41.1	-24.8	10.5	53.9	43.4	(AV) VBW:10Hz
Vert.	2493.012	AV	36.3	27.5	14.3	41.1	-24.8	12.2	53.9	41.7	(AV) VBW:10Hz
Vert.	4960.000	AV	51.1	31.4	6.9	40.8	-24.8	23.8	53.9	30.1	(AV) VBW:10Hz
Vert.	7440.000	AV	45.1	37.0	8.8	41.5	-24.8	24.6	53.9	29.3	(AV) VBW:10Hz
Vert.	9920.000	AV	33.2	38.8	9.7	38.8	-24.8	18.1	53.9	35.8	(AV) VBW:10Hz
Vert.	12400.000	AV	34.5	39.4	10.8	39.2	-24.8	20.7	53.9	33.2	(AV) VBW:10Hz

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier) + Dwell time factor (refer to "Dwell time factor Calculation")

*Other frequency noises omitted in this report were not seen or have enough margin (more than 20dB).

*The 10th harmonic was not seen so the result was its base noise level.

Distance factor : 15GHz -40GHz : $20\log(3.0m/1.0m) = 9.5dB$

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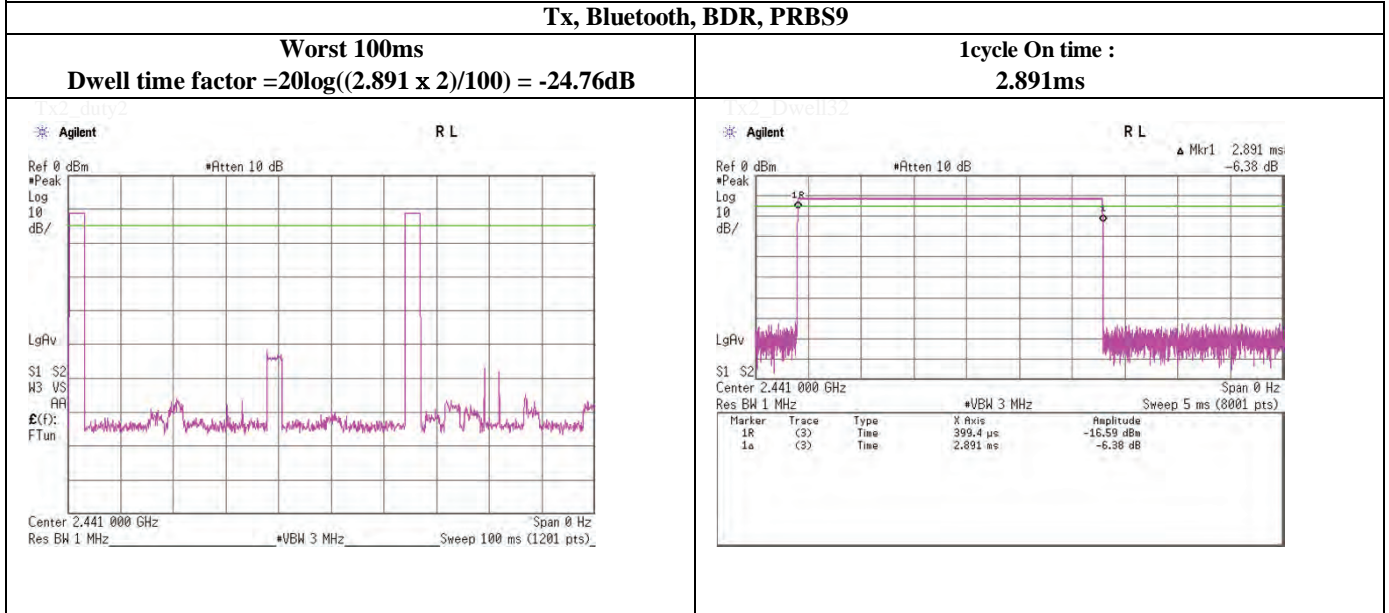
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Dwell time factor Calculation chart

Dwell time factor Calculation Tx, Bluetooth, BDR, PRBS9



VBW (Average) Calculation

*Although 00-705 accepts VBW=10Hz for AV measurements, confirmed that superfluous smoothing was not performed.

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Radiated Emission

Test place UL Japan, Inc. Shonan EMC Lab. No.3 Semi Anechoic Chamber
 Date July 3, 2012 June 26, 2012
 Temperature / Humidity 25 deg.C , 62 %RH 25 deg.C , 59 %RH
 Engineer Makoto Hosaka Makoto Hosaka
 Mode Tx, 2402 MHz
 Tx, Bluetooth, EDR, PRBS9

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]		Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	129.921	QP	31.0	13.6	7.5	32.1		20.0	43.5	23.5	150	63	
Hori.	2390.000	PK	46.9	27.2	14.2	41.1		47.2	73.9	26.7	100	348	
Hori.	4804.000	PK	70.4	31.1	6.8	41.1		67.2	73.9	6.7	117	27	
Hori.	7206.000	PK	55.1	36.5	8.3	41.3		58.6	73.9	15.3	133	325	
Hori.	9608.000	PK	46.4	38.2	9.4	38.8		55.2	73.9	18.7	100	17	
Hori.	12010.000	PK	47.1	39.3	10.7	39.2		57.9	73.9	16.0	124	202	
Vert.	37.998	QP	30.2	14.8	6.6	32.2		19.4	40.0	20.6	100	128	
Vert.	54.748	QP	33.8	9.8	6.8	32.2		18.2	40.0	21.8	100	170	
Vert.	111.434	QP	32.2	11.5	7.3	32.1		18.9	43.5	24.6	100	69	
Vert.	182.004	QP	31.2	15.9	7.8	32.1		22.8	43.5	20.7	100	159	
Vert.	988.774	QP	22.0	23.2	11.0	30.3		25.9	53.9	28.0	100	233	
Vert.	2390.000	PK	47.5	27.2	14.2	41.1		47.8	73.9	26.1	112	145	
Vert.	4804.000	PK	64.7	31.1	6.8	41.1		61.5	73.9	12.4	100	202	
Vert.	7206.000	PK	52.8	36.5	8.3	41.3		56.3	73.9	17.6	118	324	
Vert.	9608.000	PK	44.7	38.2	9.4	38.8		53.5	73.9	20.4	100	203	
Vert.	12010.000	PK	46.1	39.3	10.7	39.2		56.9	73.9	17.0	100	179	

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	34.5	27.2	14.2	41.1	-24.8	10.0	53.9	43.9	(AV) VBW:10Hz
Hori.	4804.000	AV	63.3	31.1	6.8	41.1	-24.8	35.3	53.9	18.6	(AV) VBW:10Hz
Hori.	7206.000	AV	45.2	36.5	8.3	41.3	-24.8	23.9	53.9	30.0	(AV) VBW:10Hz
Hori.	9608.000	AV	34.2	38.2	9.4	38.8	-24.8	18.2	53.9	35.7	(AV) VBW:10Hz
Hori.	12010.000	AV	34.8	39.3	10.7	39.2	-24.8	20.8	53.9	33.1	(AV) VBW:10Hz
Vert.	2390.000	AV	34.4	27.2	14.2	41.1	-24.8	9.9	53.9	44.0	(AV) VBW:10Hz
Vert.	4804.000	AV	57.5	31.1	6.8	41.1	-24.8	29.5	53.9	24.4	(AV) VBW:10Hz
Vert.	7206.000	AV	42.4	36.5	8.3	41.3	-24.8	21.1	53.9	32.8	(AV) VBW:10Hz
Vert.	9608.000	AV	32.7	38.2	9.4	38.8	-24.8	16.7	53.9	37.2	(AV) VBW:10Hz
Vert.	12010.000	AV	34.0	39.3	10.7	39.2	-24.8	20.0	53.9	33.9	(AV) VBW:10Hz

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier) + Dwell time factor (refer to "Dwell time factor Calculation")

*Other frequency noises omitted in this report were not seen or have enough margin (more than 20dB).

*The 10th harmonic was not seen so the result was its base noise level.

Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

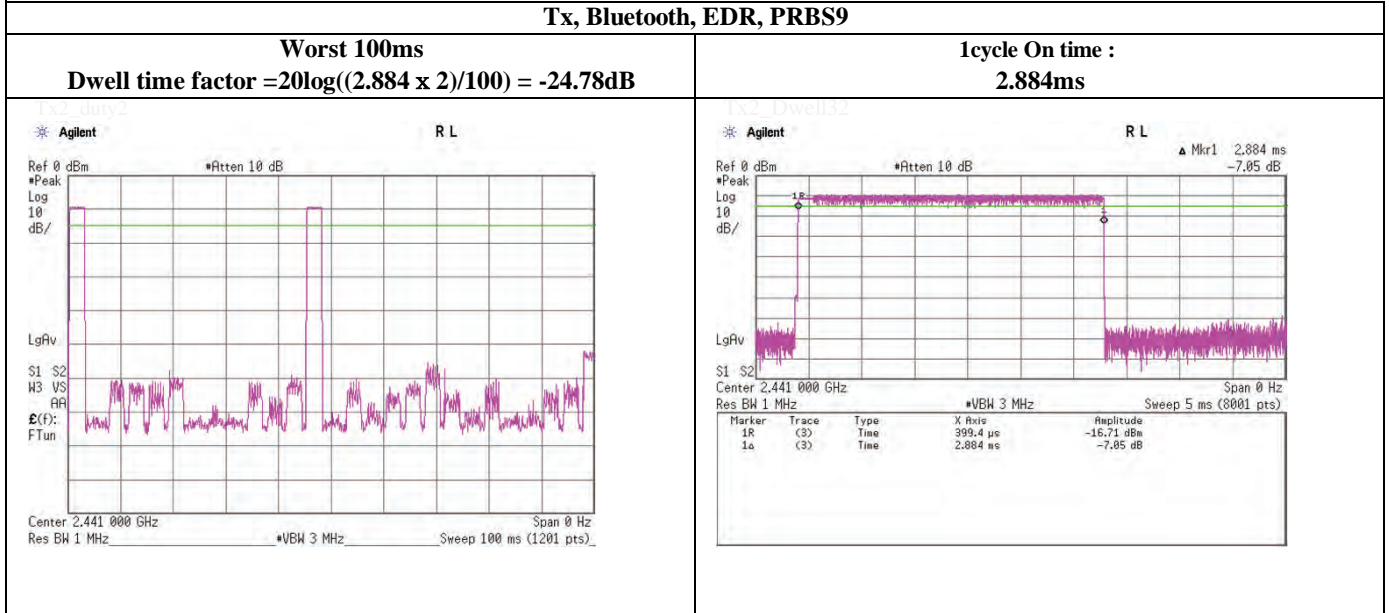
20dBc Data Sheet (RBW 100kHz, VBW 300kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]		Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	91.4	27.3	14.2	41.1		91.8	-	-	Carrier
Hori.	2396.350	PK	37.4	27.3	14.2	41.1		37.8	71.8	34.0	
Hori.	2400.000	PK	42.7	27.3	14.2	41.1		43.1	71.8	28.7	
Vert.	2402.000	PK	90.7	27.3	14.2	41.1		91.1	-	-	Carrier
Vert.	2396.350	PK	37.1	27.3	14.2	41.1		37.5	71.1	33.6	
Vert.	2400.000	PK	42.5	27.3	14.2	41.1		42.9	71.1	28.2	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier)

Dwell time factor Calculation chart

Dwell time factor Calculation Tx, Bluetooth, EDR, PRBS9



VBW (Average) Calculation

*Although 00-705 accepts VBW=10Hz for AV measurements, confirmed that superfluous smoothing was not performed.

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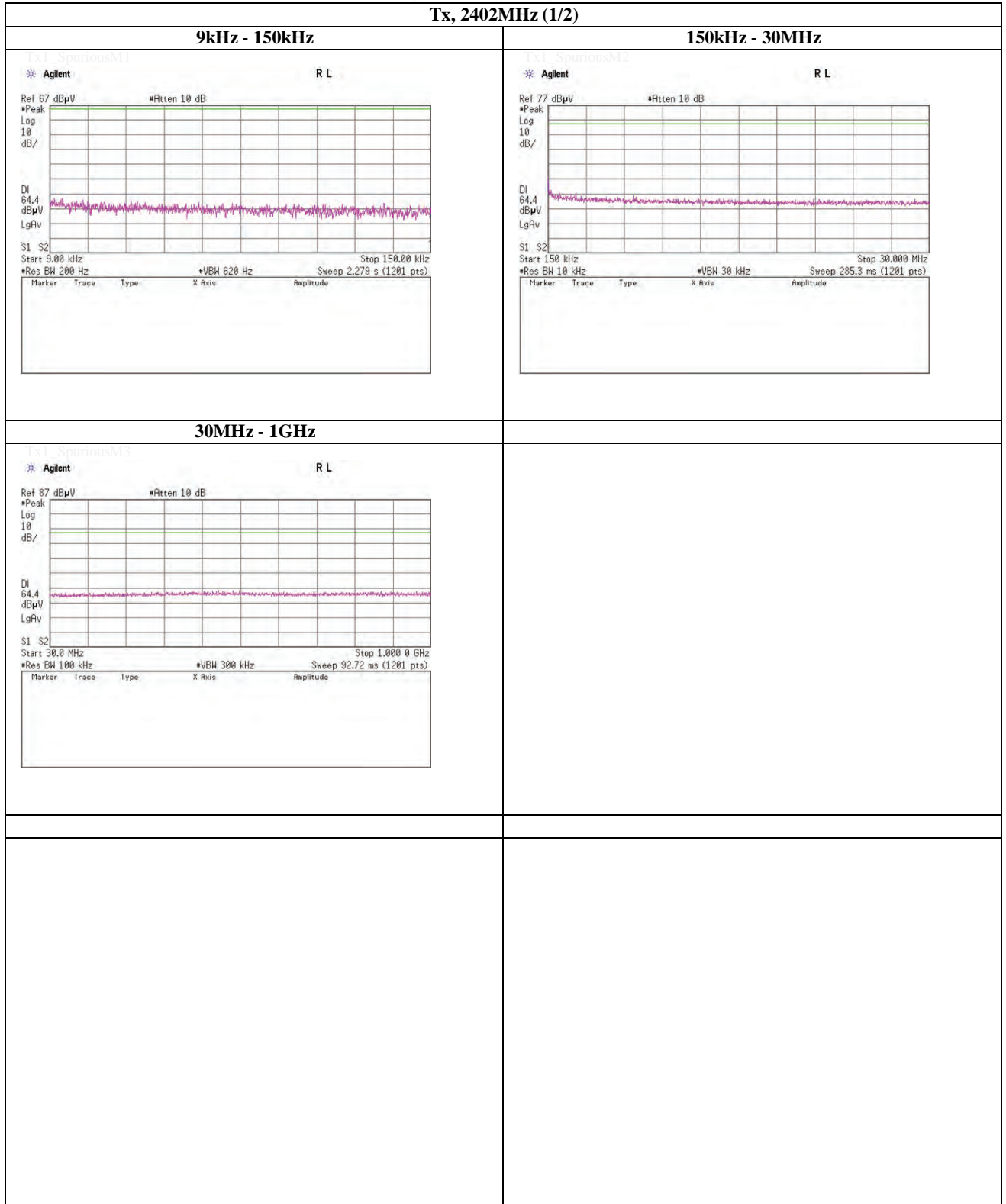
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Spurious emission (Conducted)

Tx, Bluetooth, BDR, PRBS9

Tx, 2402MHz (1/2)

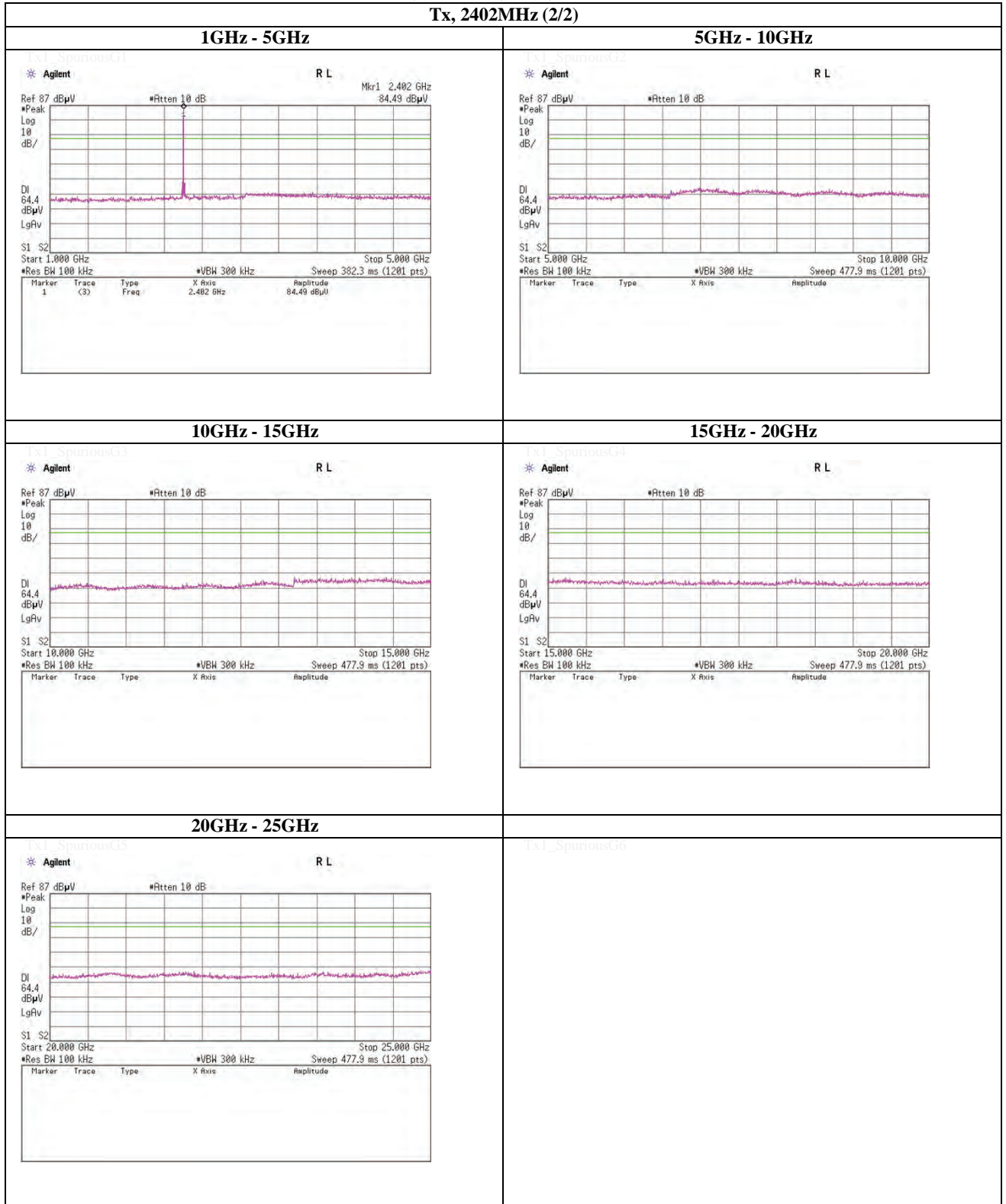


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Spurious emission (Conducted)

Tx, Bluetooth, BDR, PRBS9

Tx, 2402MHz (2/2)



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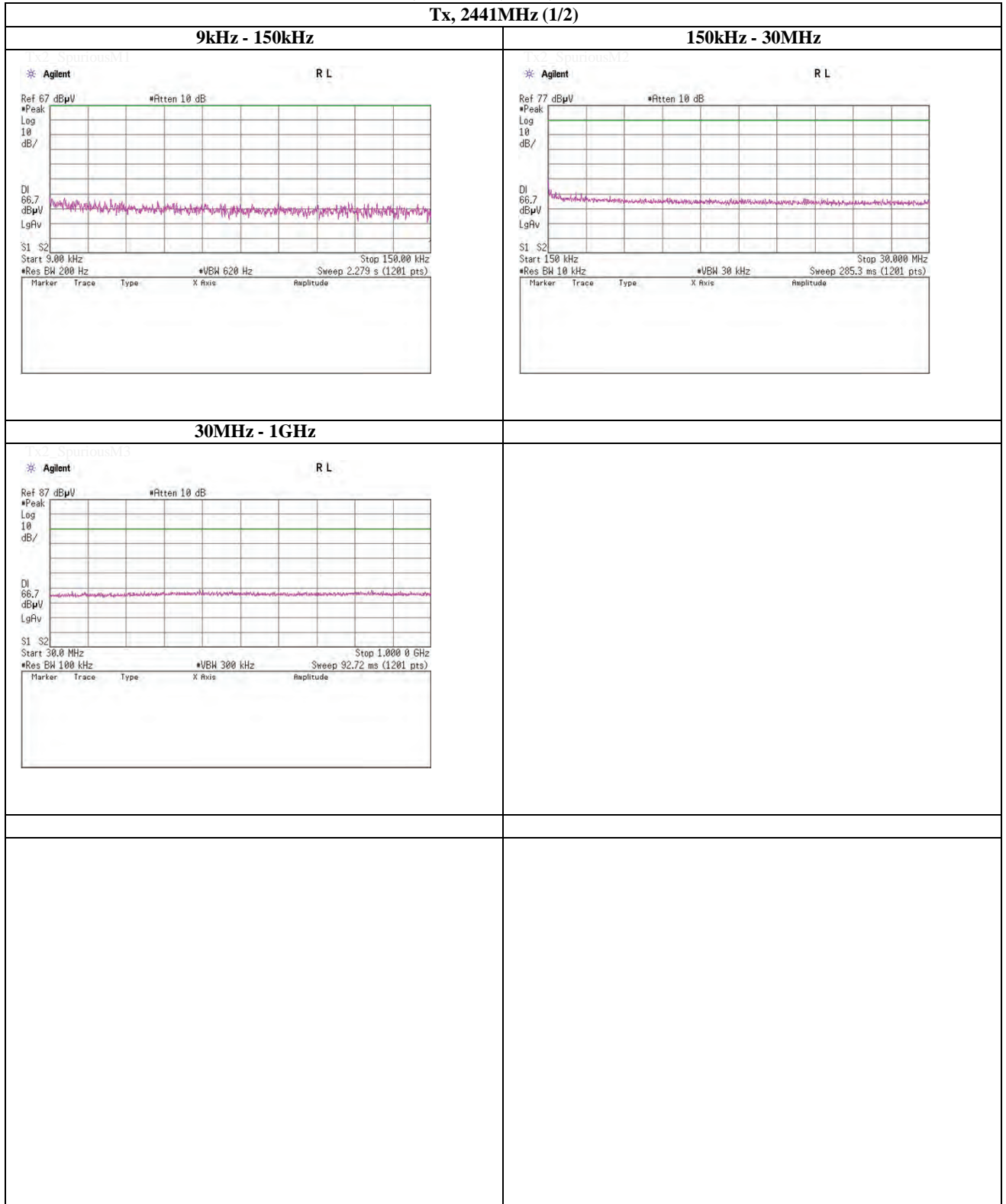
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Spurious emission (Conducted)

Tx, Bluetooth, BDR, PRBS9

Tx, 2441MHz (1/2)

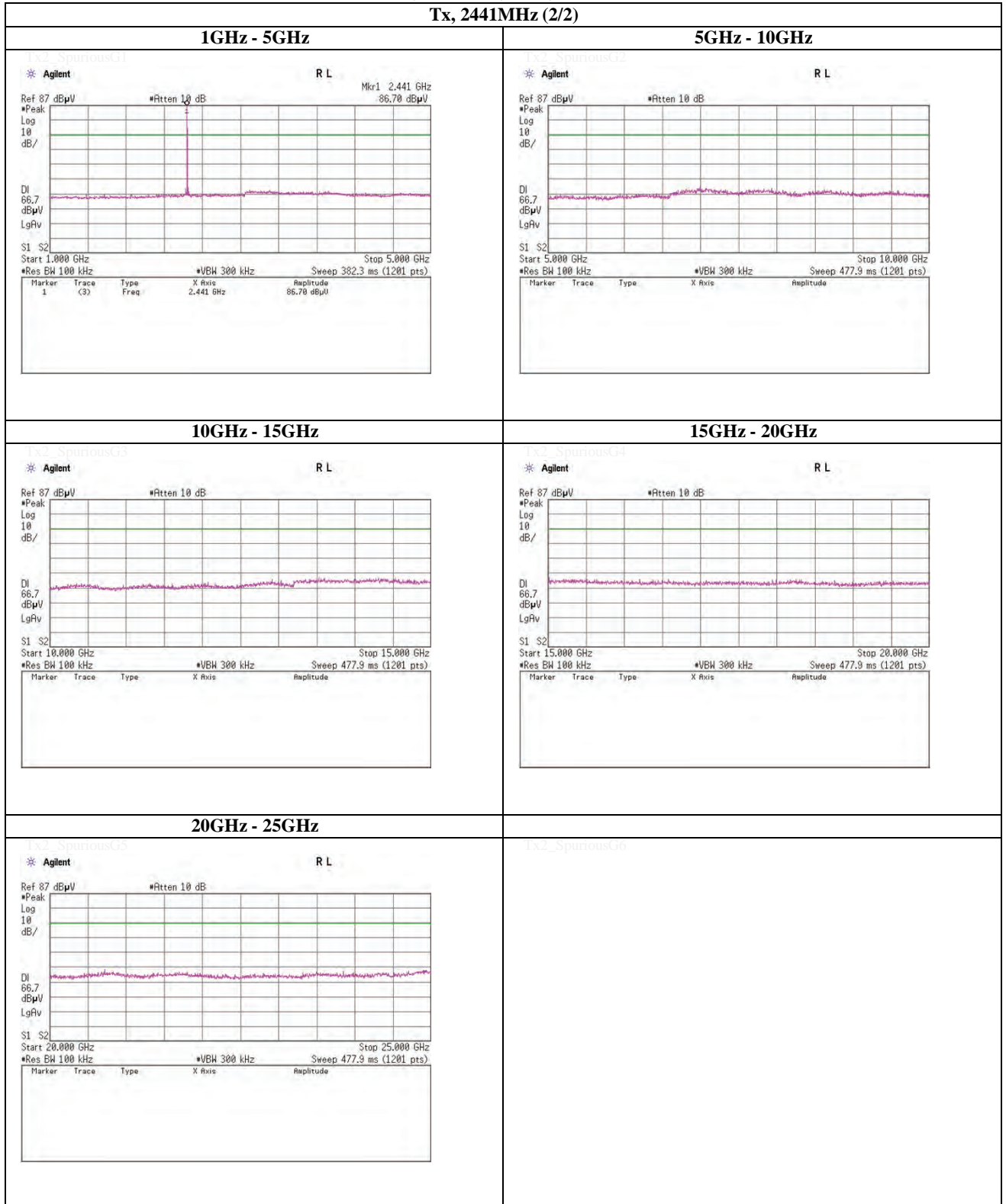


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Spurious emission (Conducted)

Tx, Bluetooth, BDR, PRBS9

Tx, 2441MHz (2/2)



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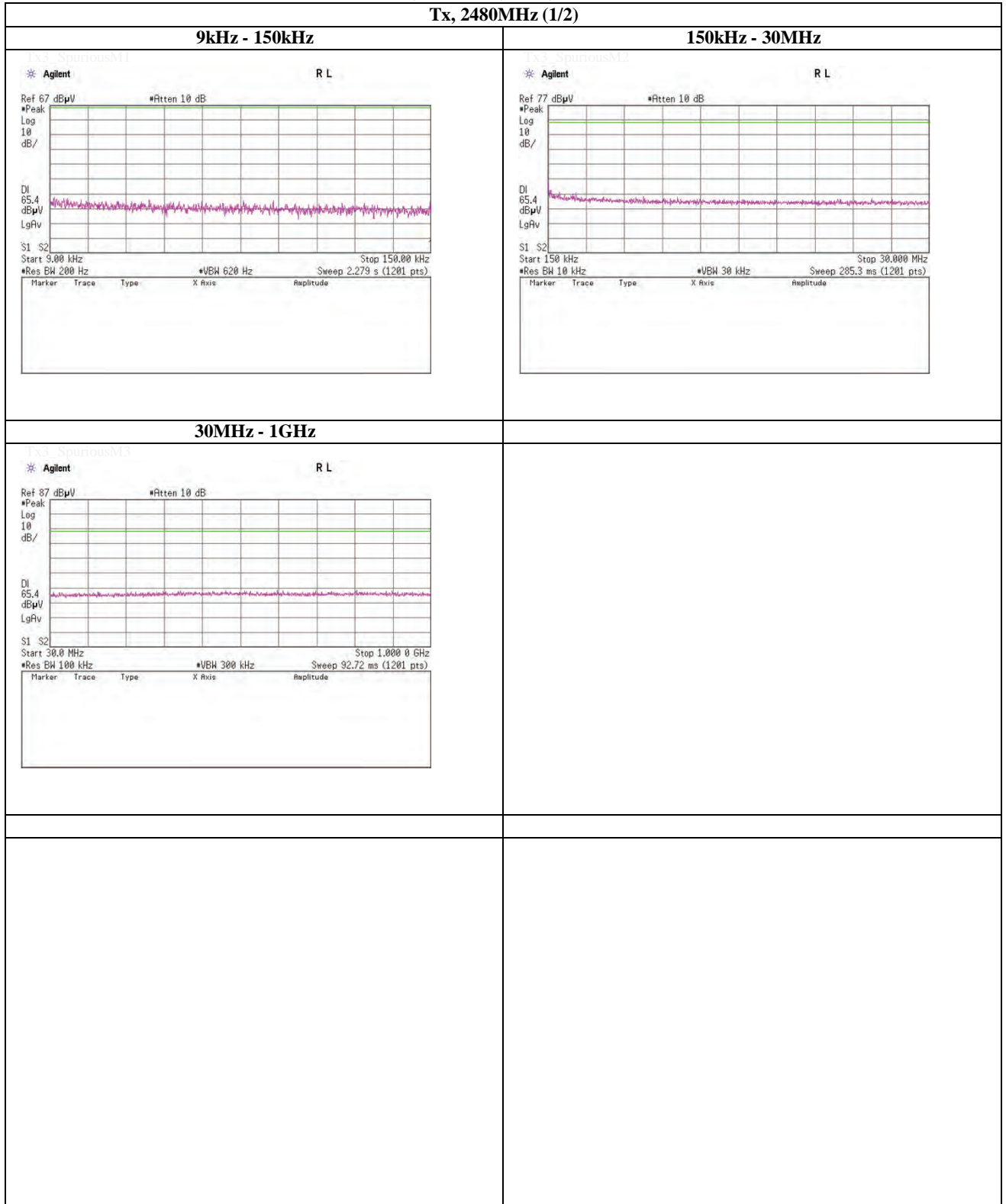
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Spurious emission (Conducted)

Tx, Bluetooth, BDR, PRBS9

Tx, 2480MHz (1/2)

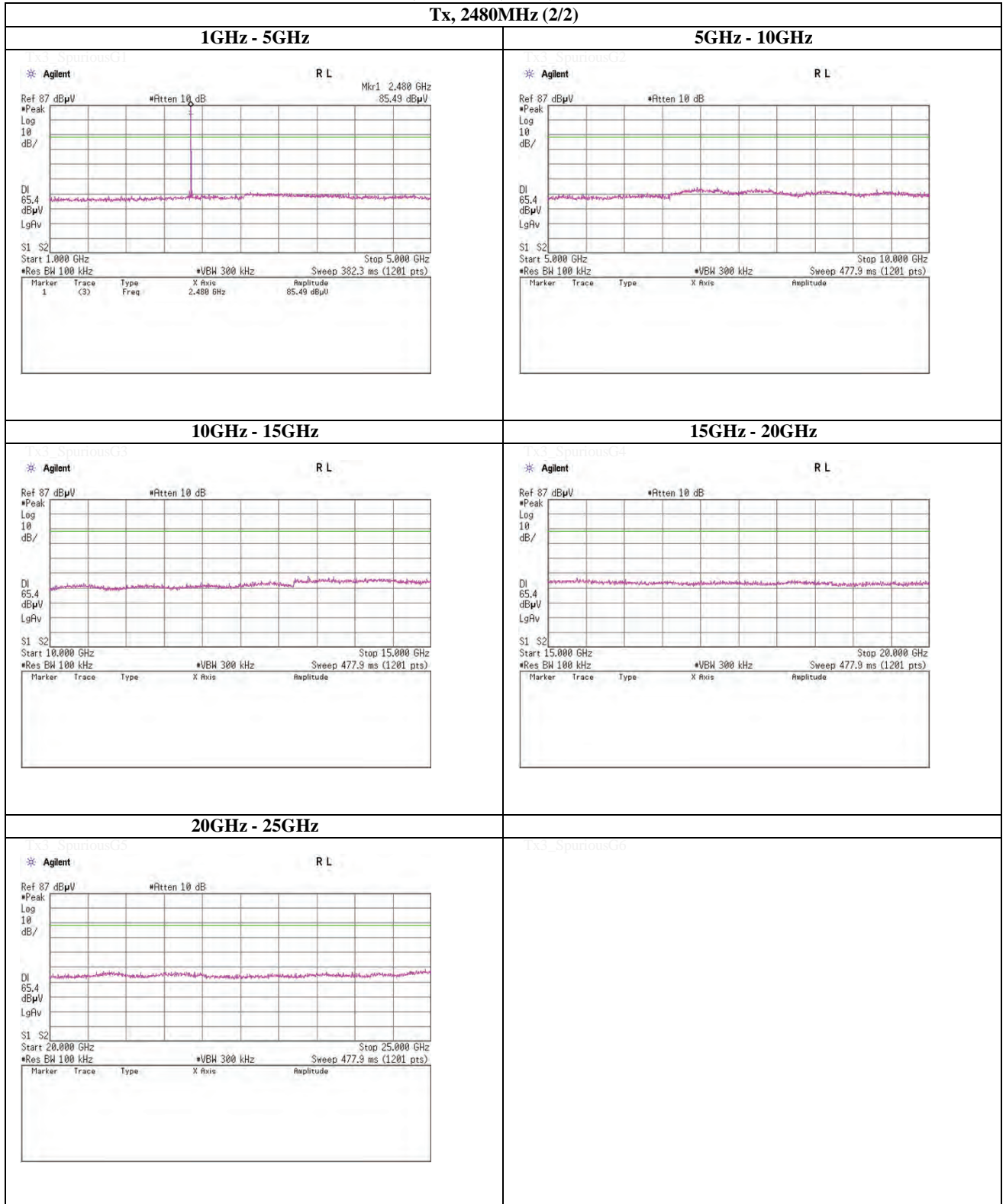


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Spurious emission (Conducted)

Tx, Bluetooth, BDR, PRBS9

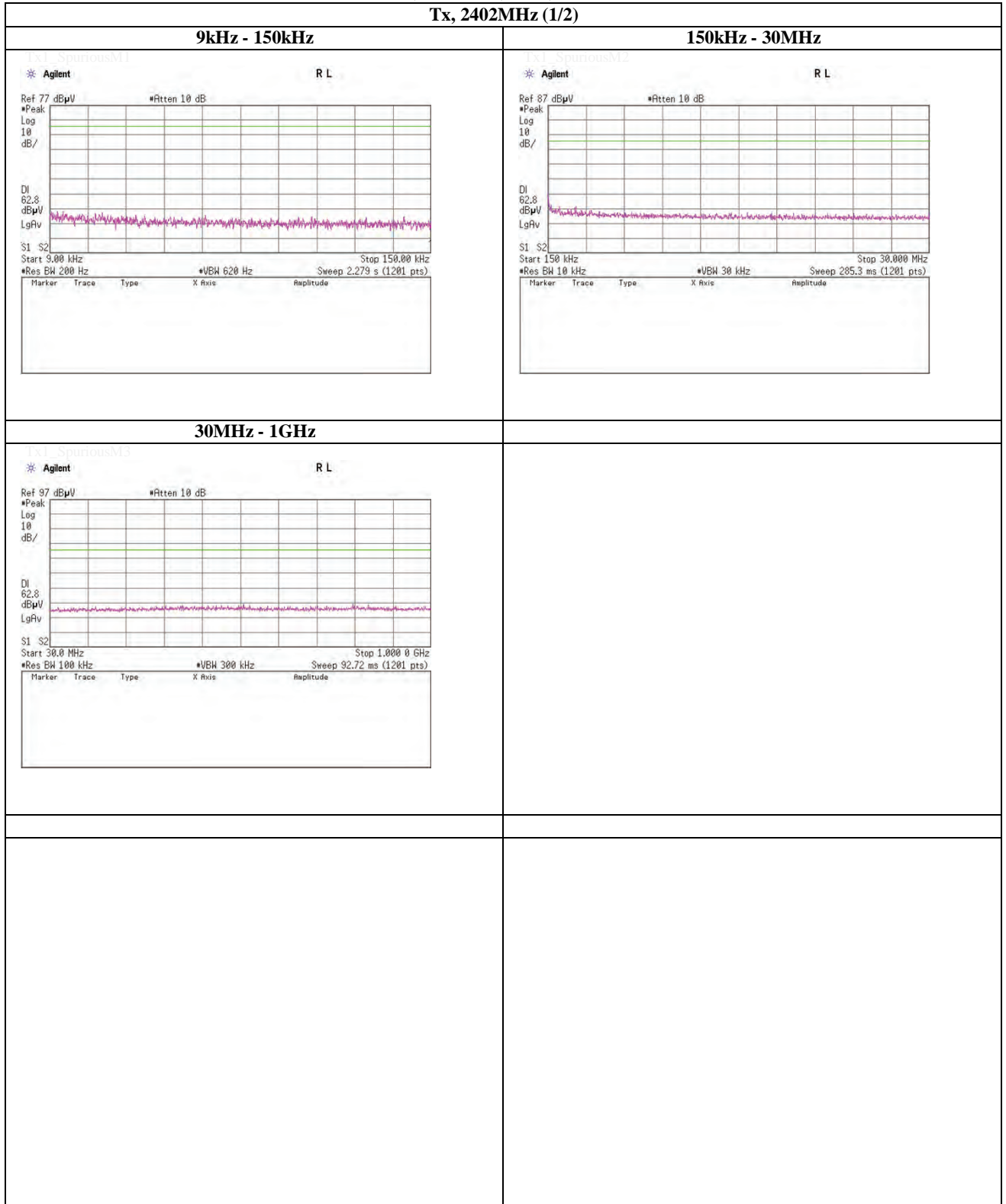
Tx, 2480MHz (2/2)



Spurious emission (Conducted)

Tx, Bluetooth, EDR, PRBS9

Tx, 2402MHz (1/2)

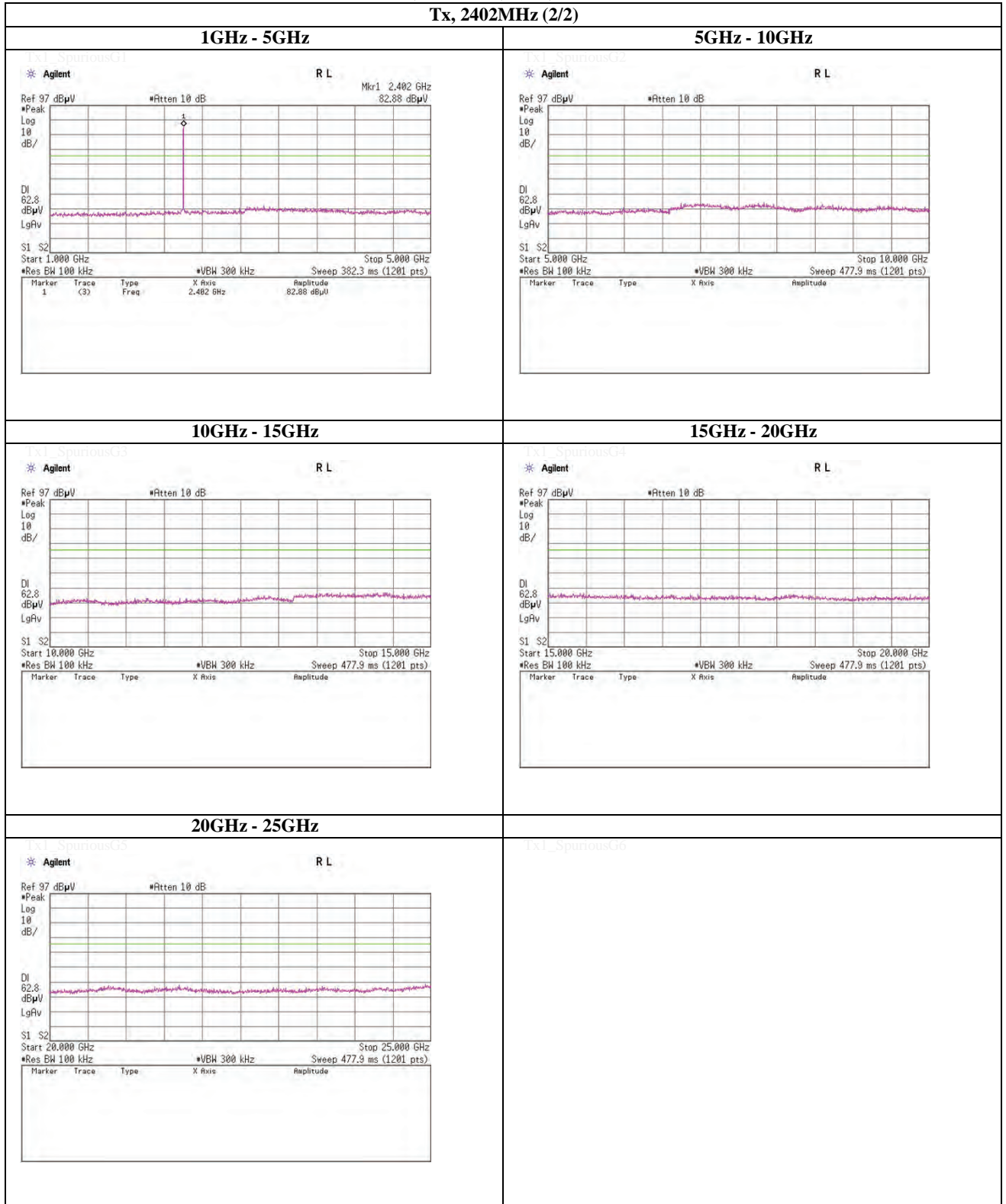


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Spurious emission (Conducted)

Tx, Bluetooth, EDR, PRBS9

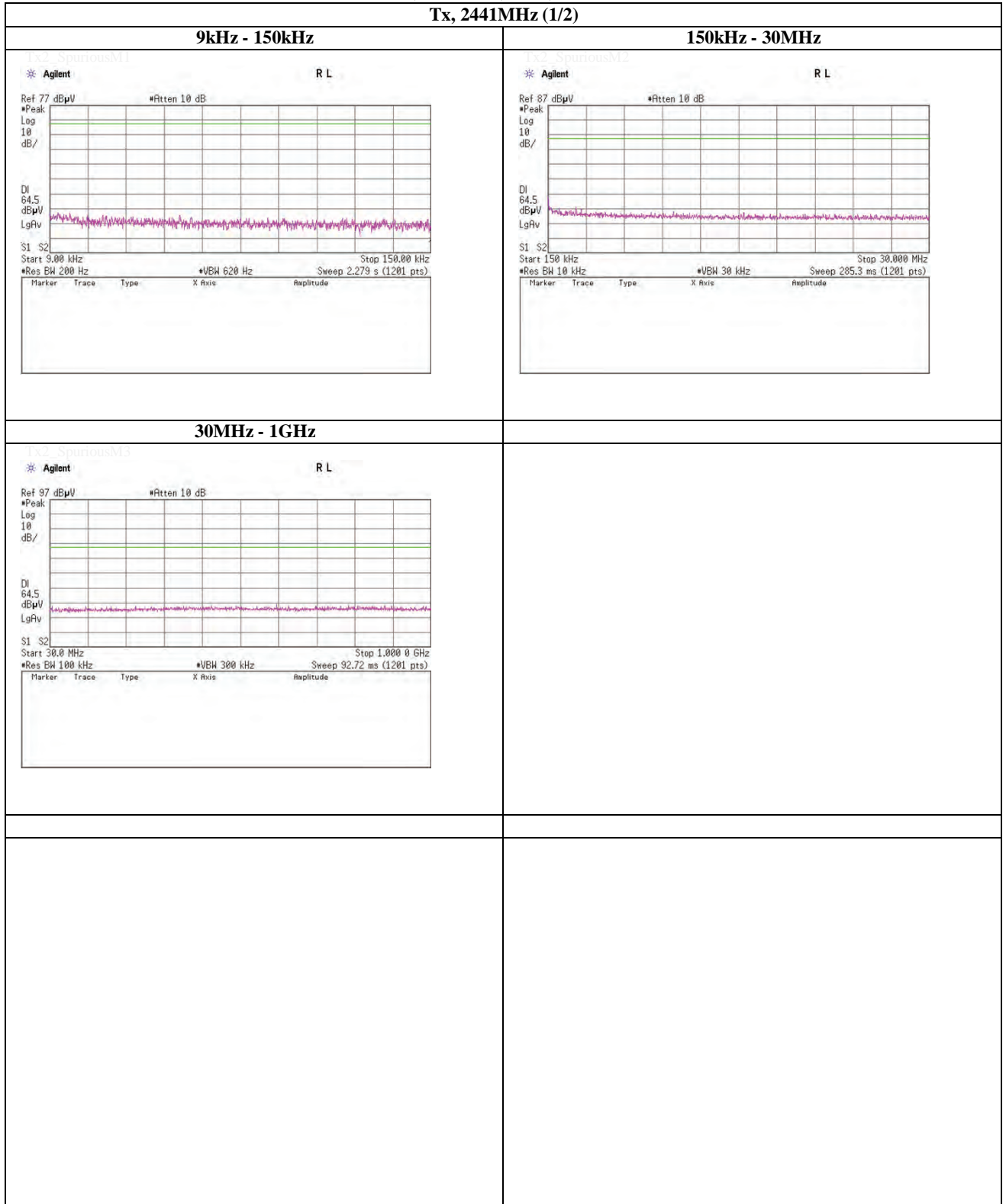
Tx, 2402MHz (2/2)



Spurious emission (Conducted)

Tx, Bluetooth, EDR, PRBS9

Tx, 2441MHz (1/2)

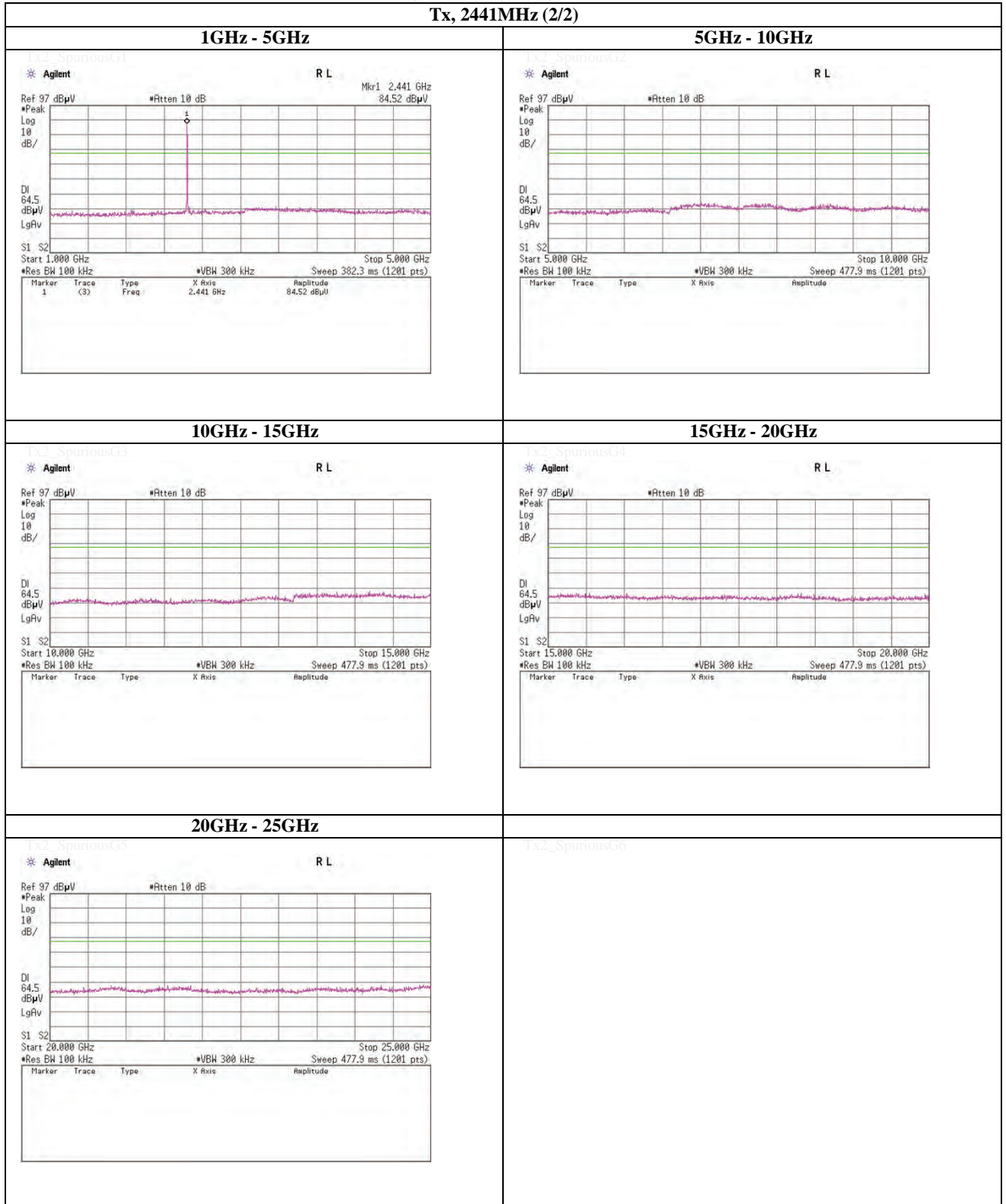


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Spurious emission (Conducted)

Tx, Bluetooth, EDR, PRBS9

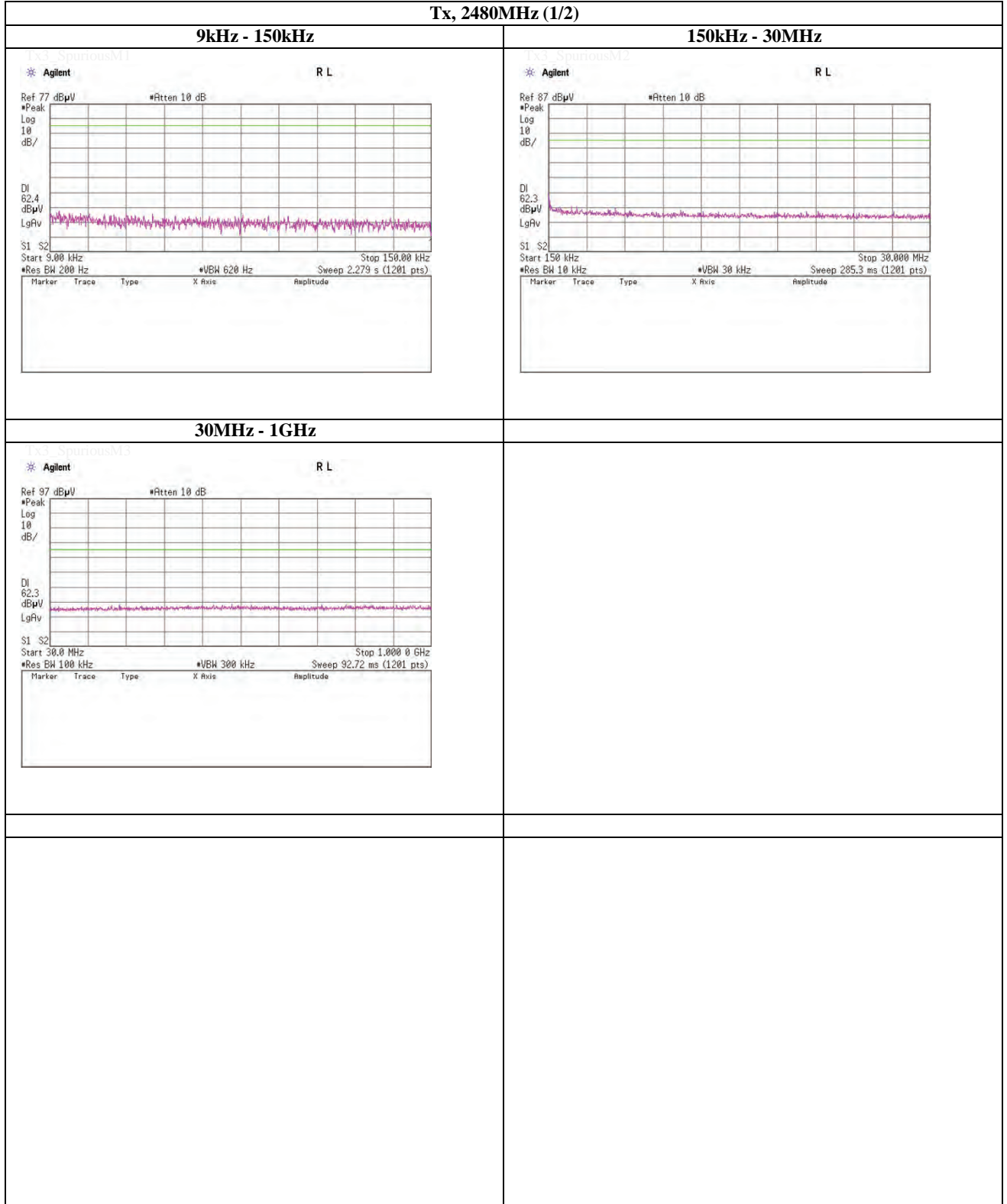
Tx, 2441MHz (2/2)



Spurious emission (Conducted)

Tx, Bluetooth, EDR, PRBS9

Tx, 2480MHz (1/2)

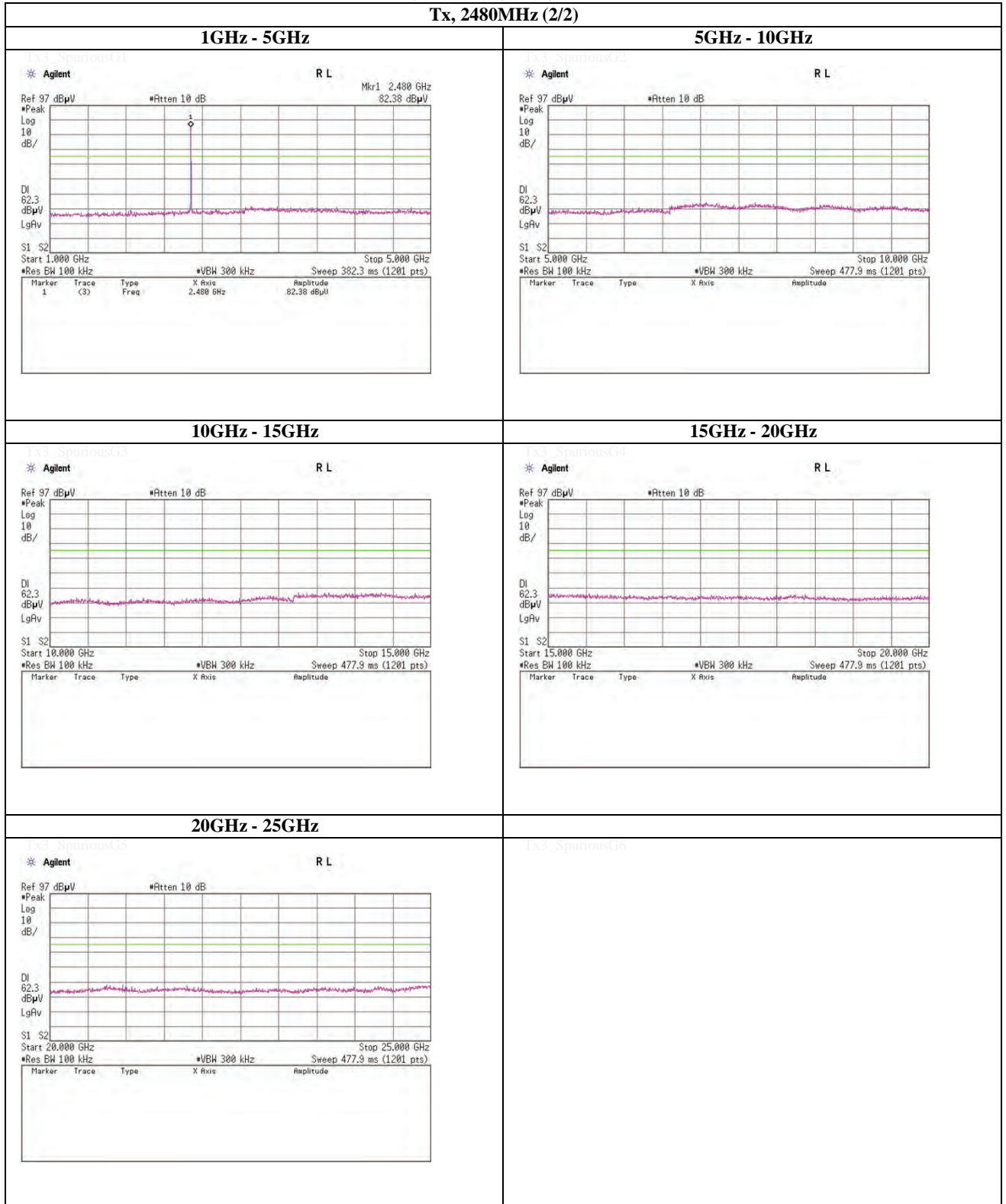


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Spurious emission (Conducted)

Tx, Bluetooth, EDR, PRBS9

Tx, 2480MHz (2/2)



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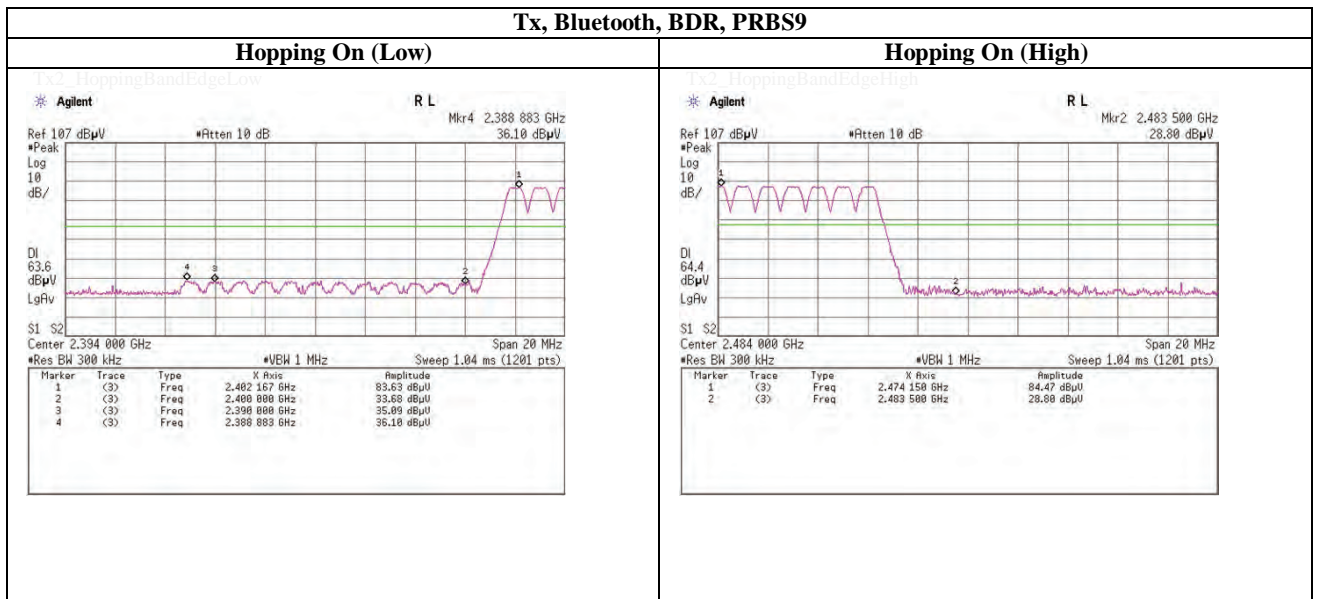
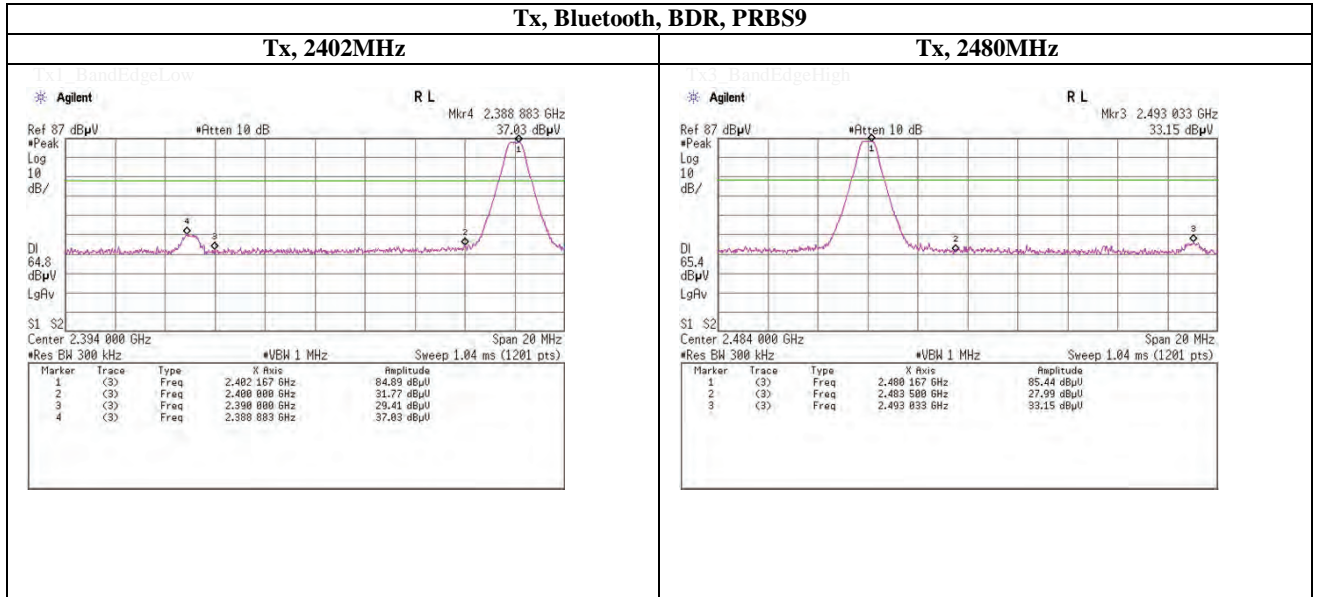
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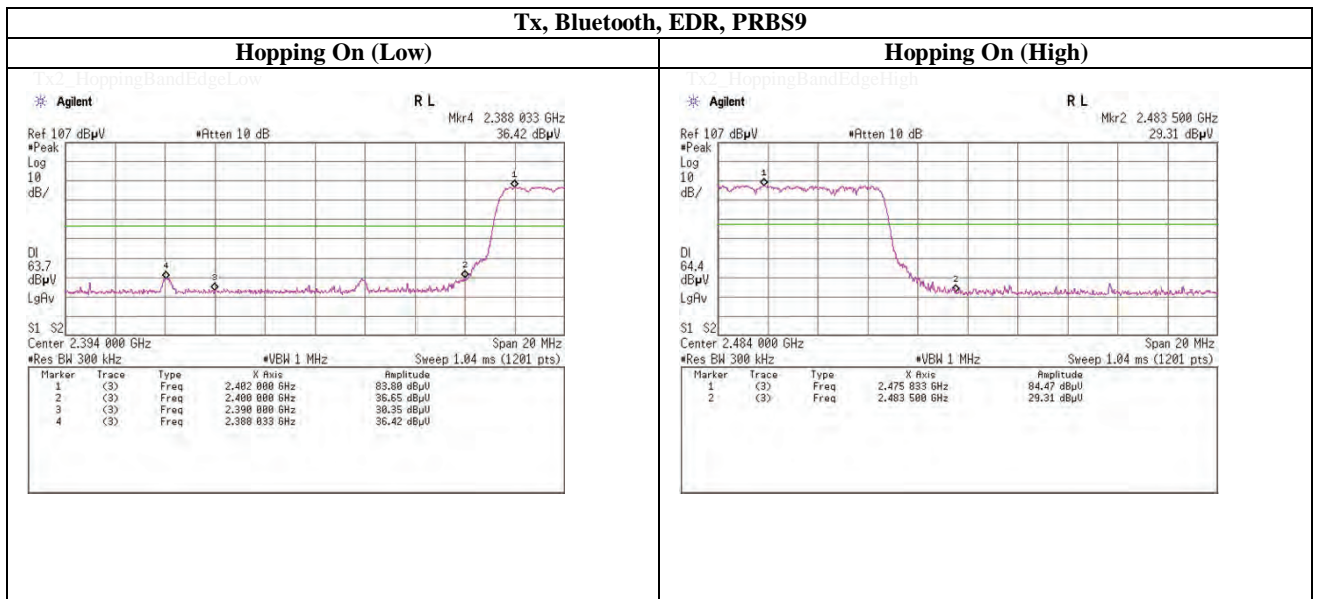
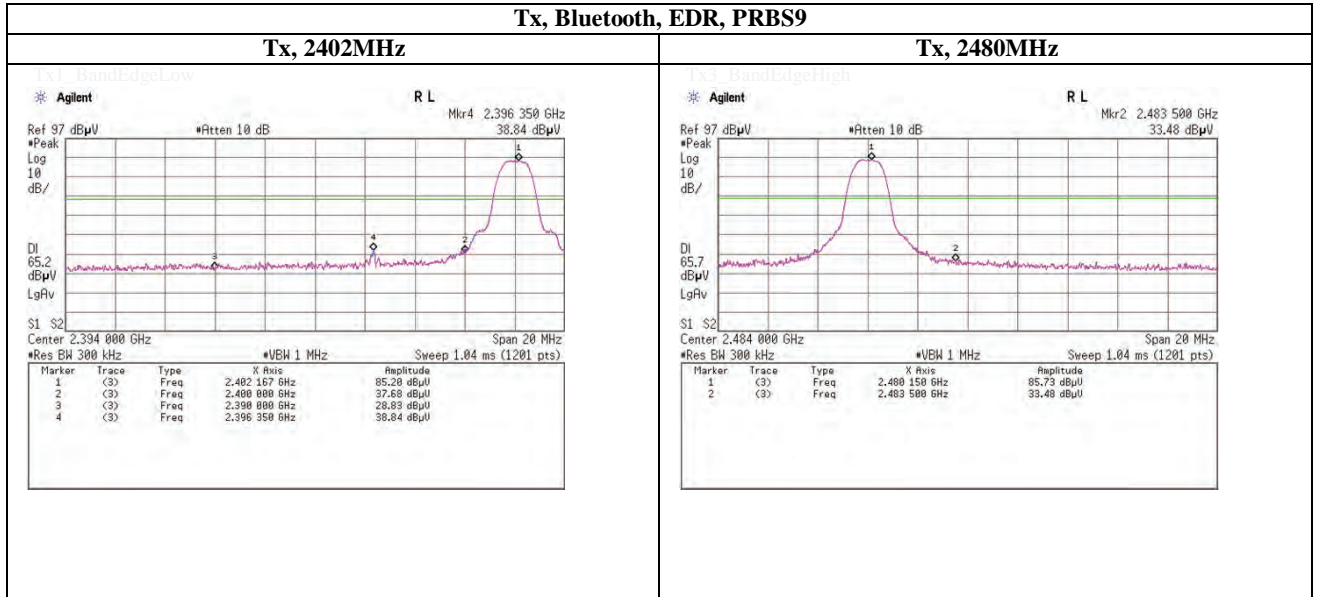
Spurious emission (Conducted)

Band Edge compliance

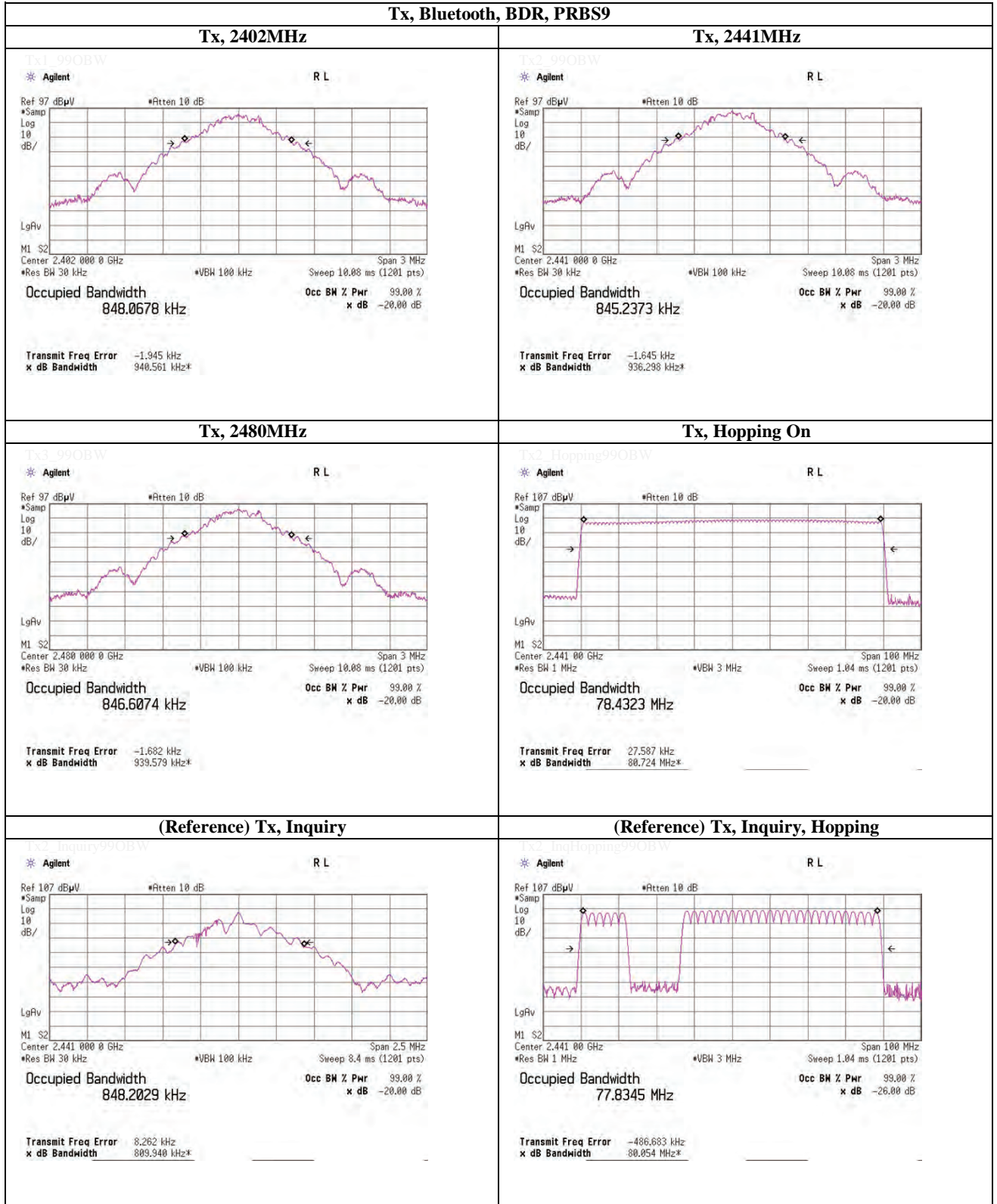


Spurious emission (Conducted)

Band Edge compliance



99% Occupied Bandwidth



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99% Occupied Bandwidth

Tx, Bluetooth, EDR, PRBS9	
<p style="text-align: center;">Tx, 2402MHz</p> <p>Tx1_99OBW * Agilent R L</p> <p>Ref 107 dBµV *Atten 10 dB</p> <p>*Samp Log 10 dB/</p> <p>LgAv</p> <p>M1 S2 Center 2.402 000 0 GHz Span 3 MHz *Res BW 30 kHz *VBW 100 kHz Sweep 10.08 ms (1201 pts)</p> <p>Occupied Bandwidth 1.1925 MHz</p> <p>Occ BW % Pwr 99.00 % x dB -20.00 dB</p> <p>Transmit Freq Error -145.064 Hz x dB Bandwidth 1.305 MHz*</p>	<p style="text-align: center;">Tx, 2441MHz</p> <p>Tx1_99OBW * Agilent R L</p> <p>Ref 107 dBµV *Atten 10 dB</p> <p>*Samp Log 10 dB/</p> <p>LgAv</p> <p>M1 S2 Center 2.441 000 0 GHz Span 3 MHz *Res BW 30 kHz *VBW 100 kHz Sweep 10.08 ms (1201 pts)</p> <p>Occupied Bandwidth 1.2218 MHz</p> <p>Occ BW % Pwr 99.00 % x dB -20.00 dB</p> <p>Transmit Freq Error -5.973 kHz x dB Bandwidth 1.298 MHz*</p>
<p style="text-align: center;">Tx, 2480MHz</p> <p>Tx3_99OBW * Agilent R L</p> <p>Ref 107 dBµV *Atten 10 dB</p> <p>*Samp Log 10 dB/</p> <p>LgAv</p> <p>M1 S2 Center 2.480 000 0 GHz Span 3 MHz *Res BW 30 kHz *VBW 100 kHz Sweep 10.08 ms (1201 pts)</p> <p>Occupied Bandwidth 1.1937 MHz</p> <p>Occ BW % Pwr 99.00 % x dB -20.00 dB</p> <p>Transmit Freq Error -177.253 Hz x dB Bandwidth 1.305 MHz*</p>	<p style="text-align: center;">Tx, Hopping On</p> <p>Tx2_Hopping99OBW * Agilent R L</p> <p>Ref 107 dBµV *Atten 10 dB</p> <p>*Samp Log 10 dB/</p> <p>LgAv</p> <p>M1 S2 Center 2.441 00 GHz Span 100 MHz *Res BW 1 MHz *VBW 3 MHz Sweep 1.04 ms (1201 pts)</p> <p>Occupied Bandwidth 78.5871 MHz</p> <p>Occ BW % Pwr 99.00 % x dB -20.00 dB</p> <p>Transmit Freq Error 6.911 kHz x dB Bandwidth 81.048 MHz*</p>
<p>Tx2_inquiry99OBW</p>	<p>Tx2_inqHopping99OBW</p>

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**APPENDIX 2
Test Instruments**

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SPM-06	Power Meter	Anritsu	ML2495A	0850009	AT	2012/04/19 * 12
SPSS-03	Power sensor	Anritsu	MA2411B	0917063	AT	2012/04/19 * 12
SSA-03	Spectrum Analyzer	Agilent	E4448A	MY48250152	AT	2011/12/05 * 12
SCC-G12	Coaxial Cable	Suhner	SUCOFLEX 102	30790/2	AT	2012/03/12 * 12
SAT10-10	Attenuator	Weinschel Corp.	54A-10	37584	AT	2012/04/06 * 12
SAT20-03	Attenuator	Agilent	8493C-020	74891	AT	2012/03/12 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2012/03/26 * 12
SAF-06	Pre Amplifier	TOYO Corporation	TPA0118-36	1440491	RE	2011/07/19 * 12
SCC-G03	Coaxial Cable	Suhner	SUCOFLEX 104A	46499/4A	RE	2012/04/10 * 12
SCC-G23	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	RE	2012/05/22 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	2011/08/28 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2012/02/06 * 12
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	RE	2012/02/16 * 12
SJM-10	Measure	PROMART	SEN1935	-	RE	-
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE, RFLMF)	-	RE	-
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE	2011/12/27 * 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2011/12/27 * 12
SAF-03	Pre Amplifier	SONOMA	310N	290213	RE	2012/02/10 * 12
SAT6-03	Attenuator	JFW	50HF-006N	-	RE	2012/02/10 * 12
SBA-03	Biconical Antenna	Schwarzbeck	BBA9106	91032666	RE	2011/10/23 * 12
SCC-C1/C2/C3/C4/C5/C10/SRSE-03	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-271(RF Selector)	RE	2012/04/10 * 12
SLA-03	Logperiodic Antenna	Schwarzbeck	UHALP9108A	UHALP 9108-A 0901	RE	2011/10/23 * 12
STR-06	Test Receiver	Rohde & Schwarz	ESCI	101259	RE	2012/02/07 * 12
SAEC-03(NSA)	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	RE	2011/09/23 * 12
SHA-04	Horn Antenna	ETS LINDGREN	3160-09	LM3640	RE	2012/03/30 * 12
SCC-G17	Coaxial Cable	Suhner	SUCOFLEX 104A	46291/4A	RE	2012/03/12 * 12
SAF-08	Pre Amplifier	TOYO Corporation	HAP18-26W	00000019	RE	2012/03/12 * 12
SFL-03	Highpass Filter	MICRO-TRONICS	HPM50112	028	RE	2011/12/27 * 12

The expiration date of the calibration is the end of the expired month .
As for some calibrations performed after the tested dates , those test equipment have been controlled by means of an unbroken chains of calibrations .

All equipment is calibrated with valid calibrations . Each measurement data is traceable to the national or international standards.

Test Item :

- RE: Radiated emission ,
- AT: Antenna terminal test