

APPENDIX 2: Data of EMI test

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

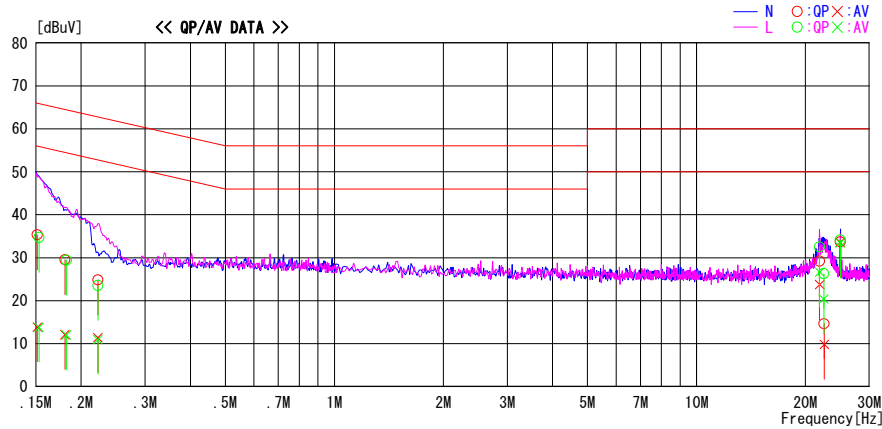
UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
Date : 2011/06/21

Report No. : 31HE0184-HO-02

Temp./Humi. : 22deg. C / 65% RH
Engineer : Keisuke Kawamura

Mode / Remarks : Tx 11n-20. MCS0. 2462MHz

LIMIT : FCC15.207 QP
FCC15.207 AV

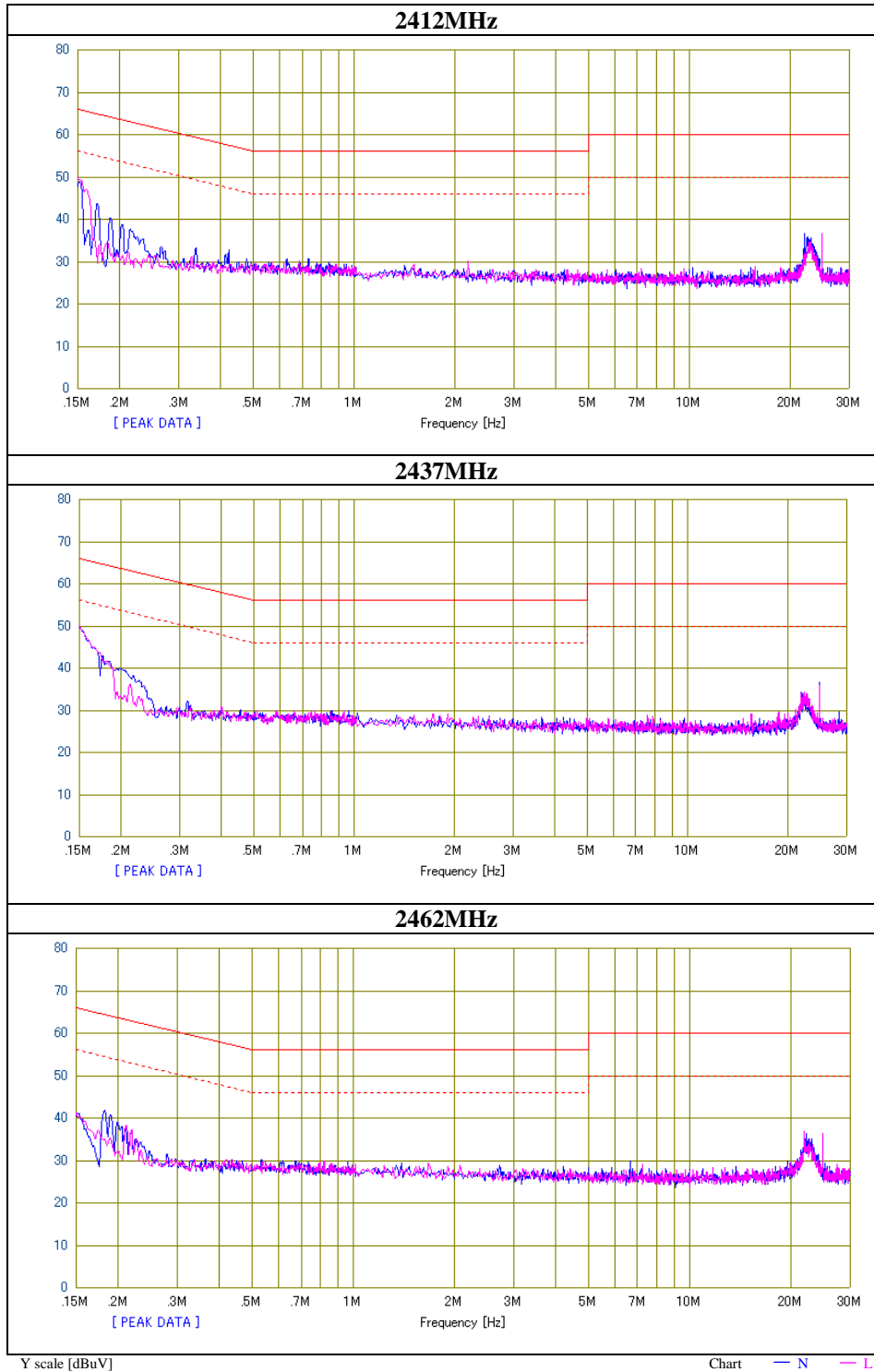


Frequency [MHz]	Reading Level		Corr. Factor	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15145	22.2	0.8	13.1	35.3	13.9	65.9	55.9	30.6	42.0	N	
0.18045	16.4	-1.0	13.1	29.5	12.1	64.5	54.5	35.0	42.4	N	
0.22251	11.5	-1.9	13.3	24.8	11.4	62.7	52.7	37.9	41.3	N	
21.89031	14.6	9.1	14.6	29.2	23.7	60.0	50.0	30.8	26.3	N	
22.51471	0.0	-4.8	14.6	14.6	9.8	60.0	50.0	45.4	40.2	N	
24.95711	19.0	18.9	14.7	33.7	33.6	60.0	50.0	26.3	16.4	N	
0.15291	21.6	0.7	13.1	34.7	13.8	65.8	55.8	31.1	42.0	L	
0.18191	16.3	-1.1	13.1	29.4	12.0	64.4	54.4	35.0	42.4	L	
0.22251	10.2	-2.3	13.3	23.5	11.0	62.7	52.7	39.2	41.7	L	
21.89026	17.9	12.0	14.6	32.5	26.6	60.0	50.0	27.5	23.4	L	
22.44786	11.7	5.8	14.6	26.3	20.4	60.0	50.0	33.7	29.6	L	
24.95762	19.4	18.7	14.7	34.1	33.4	60.0	50.0	25.9	16.6	L	

CHART: WITH FACTOR, Peak hold data. CALCULATION: RESULT [dBuV]=READING [dBuV]+C. F [dB] (LISN LOSS+CABLE LOSS)
Except for the above table : adequate margin data below the limits.

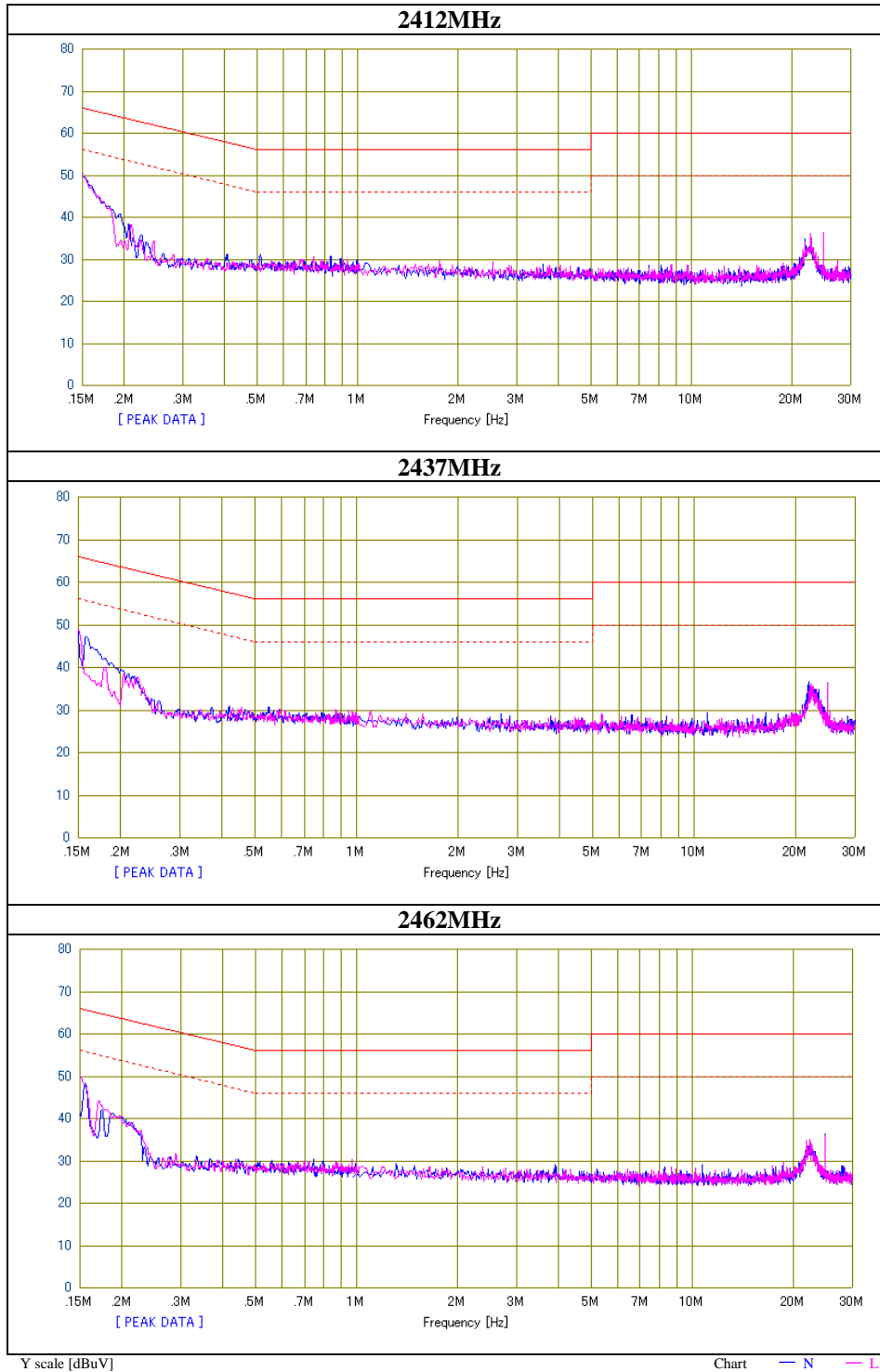
Conducted Emission

Test place : Head Office EMC Lab. No.3 Semi Anechoic Chamber
Report No. : 31HE0184-HO-02
Date : 06/21/2011
Temperature/ Humidity : 22 deg.C / 65% RH
Engineer : Keisuke Kawamura
Mode : 11b Tx



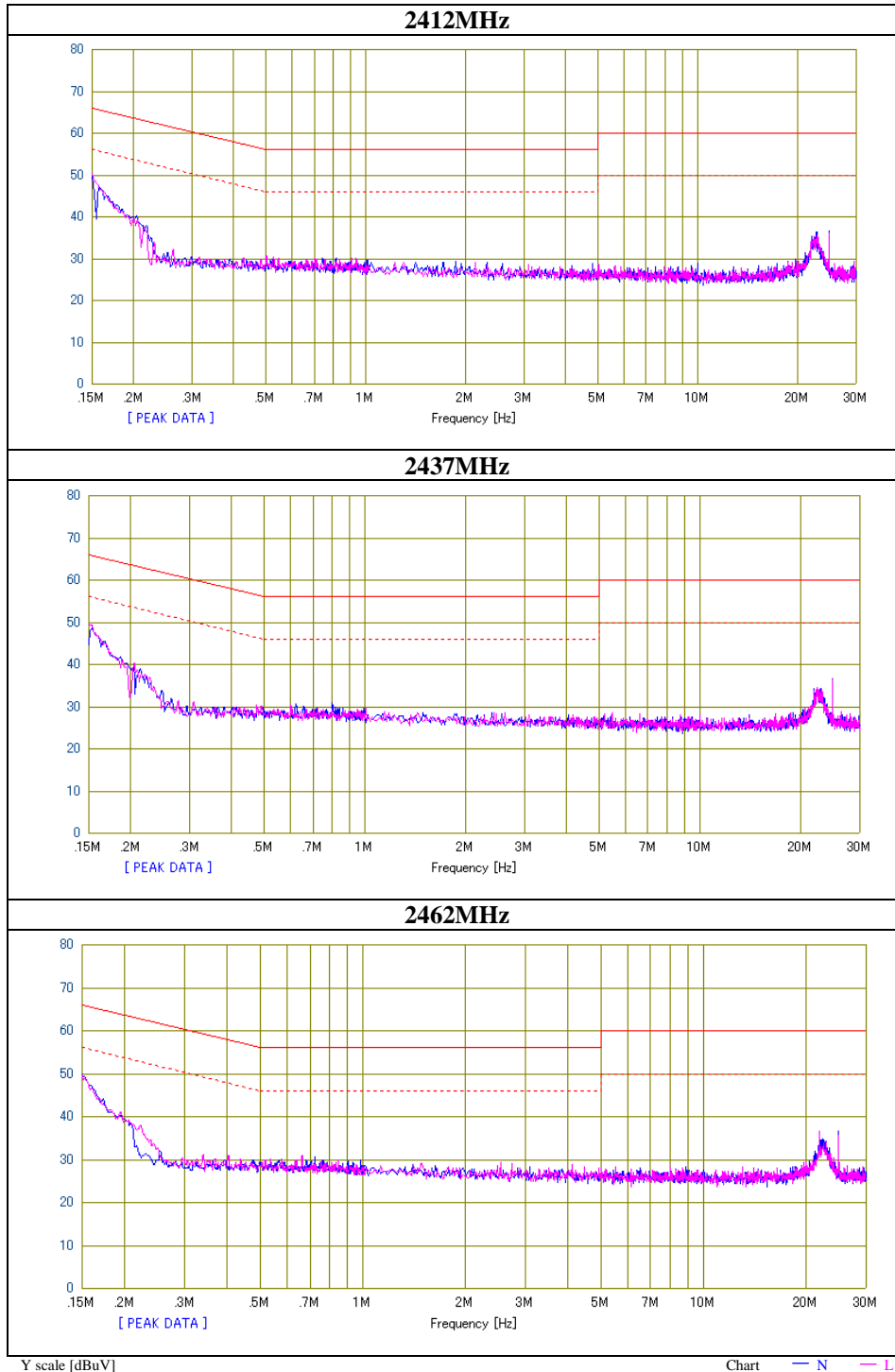
Conducted Emission

Test place	Head Office EMC Lab. No.3 Semi Anechoic Chamber
Report No.	31HE0184-HO-02
Date	06/21/2011
Temperature/ Humidity	22 deg.C / 65% RH
Engineer	Keisuke Kawamura
Mode	11g Tx



Conducted Emission

Test place	Head Office EMC Lab. No.3 Semi Anechoic Chamber
Report No.	31HE0184-HO-02
Date	06/21/2011
Temperature/ Humidity	22 deg.C / 65%RH
Engineer	Keisuke Kawamura
Mode	11n-20 Tx



6dB Bandwidth

Test place Head Office EMC Lab. No.11 Measurement Room
Report No. 31HE0184-HO-02
Date 06/14/2011
Temperature/ Humidity 26 deg.C / 51%RH
Engineer Satofumi Matsuyama
Mode Tx

11b

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2412	7.598	>500
2437	8.083	>500
2462	8.089	>500

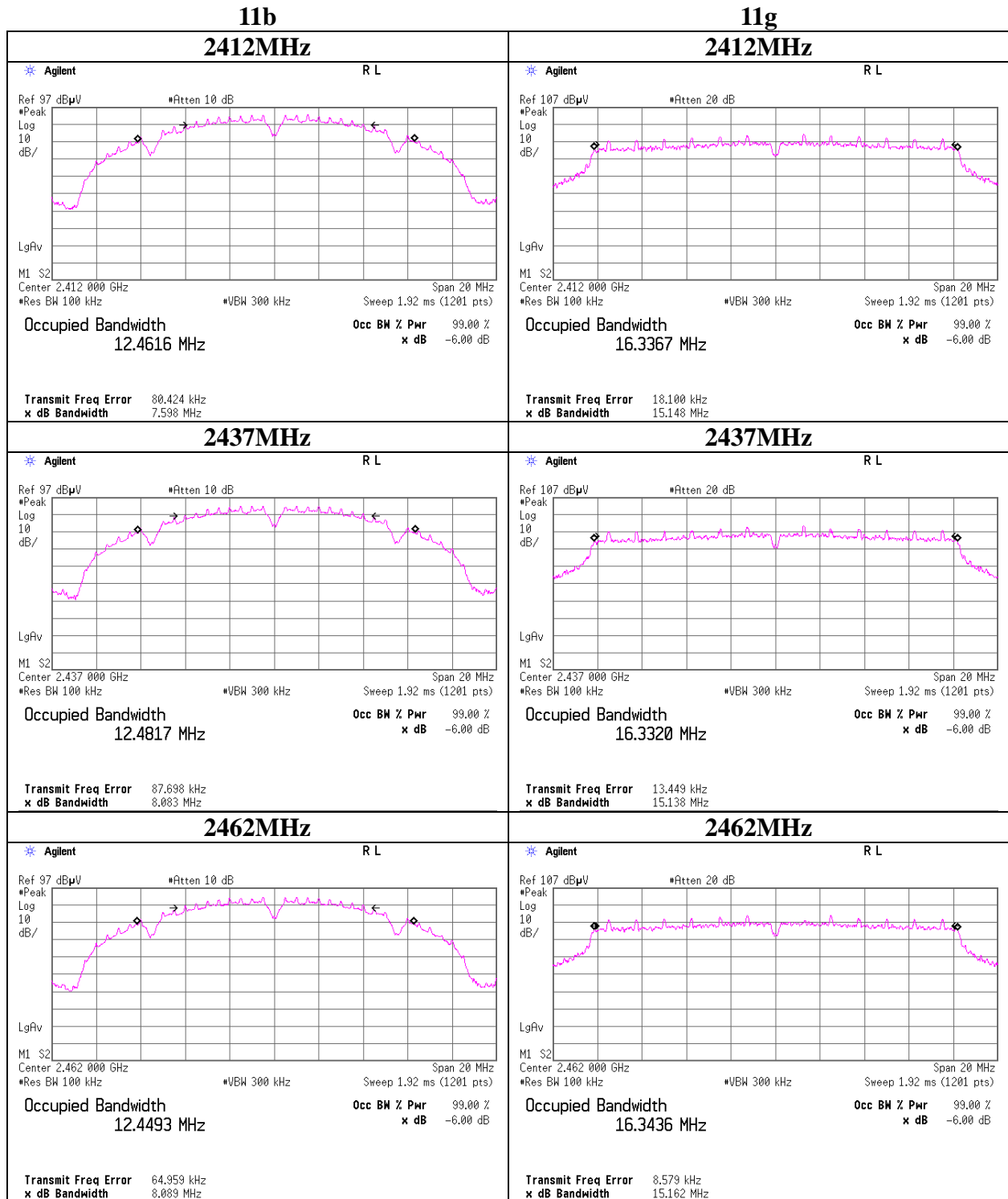
11g

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2412	15.148	>500
2437	15.138	>500
2462	15.162	>500

11n-20

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2412	15.114	>500
2437	15.146	>500
2462	15.113	>500

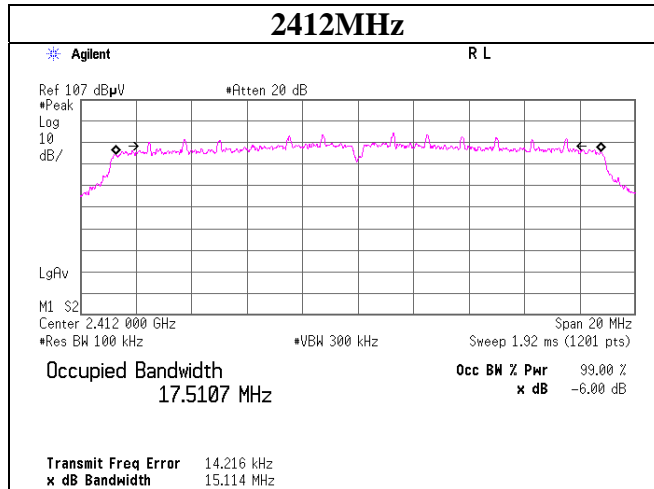
6dB Bandwidth



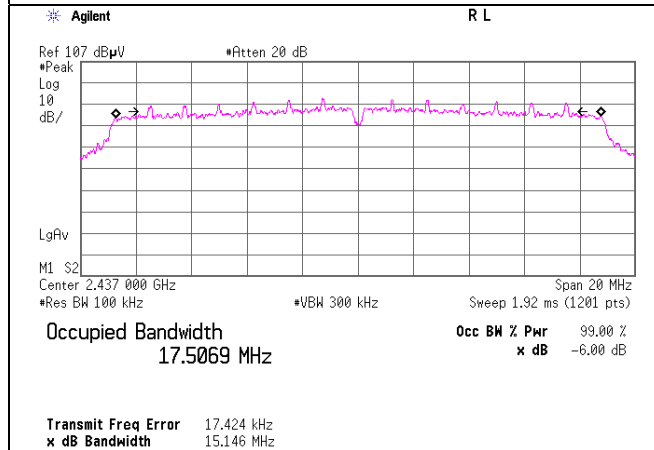
6dB Bandwidth

11n-20

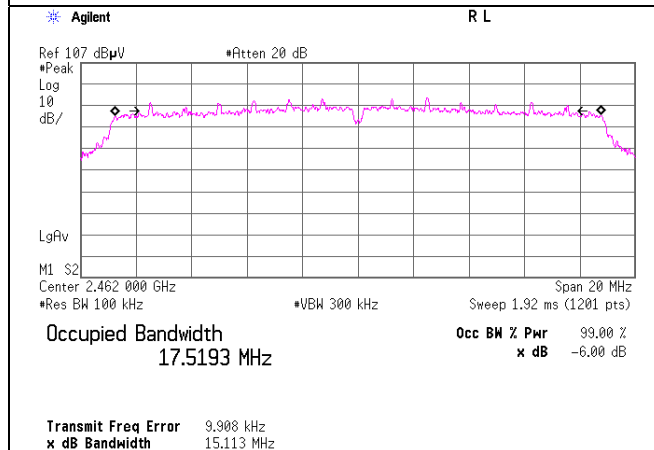
2412MHz



2437MHz



2462MHz



Maximum Peak Output Power

Test place Head Office EMC Lab. No.6 Measurement Room
Report No. 31HE0184-HO-02
Date 06/11/2011
Temperature/ Humidity 24deg. C / 52% RH
Engineer Takayuki Shimada
Mode 11b Tx

11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	-5.53	1.67	9.97	6.11	4.08	30.00	1000	23.89
2437	-6.10	1.68	9.97	5.55	3.59	30.00	1000	24.45
2462	-6.61	1.68	9.97	5.04	3.19	30.00	1000	24.96

Sample Calculation:

Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator

2437MHz

Rate [Mbps]	Reading [dBm]	Remark
1	-6.10	*
2	-7.09	
5.5	-6.45	
11	-8.69	

*: Worst Rate

All comparizon were carried out on same frequency and measurement factors.

Maximum Peak Output Power

Test place	Head Office EMC Lab. No.6 Measurement Room
Report No.	31HE0184-HO-02
Date	06/11/2011
Temperature/ Humidity	24deg. C / 52% RH
Engineer	Takayuki Shimada
Mode	11g Tx

11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	-7.20	1.67	9.97	4.44	2.78	30.00	1000	25.56
2437	-7.25	1.68	9.97	4.40	2.75	30.00	1000	25.60
2462	-7.02	1.68	9.97	4.63	2.90	30.00	1000	25.37

Sample Calculation:

Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator

2437MHz

Rate [Mbps]	Reading [dBm]	Remark
6	-9.06	
9	-7.25	*
12	-8.82	
18	-7.98	
24	-8.94	
36	-8.88	
48	-9.26	
54	-9.71	

*: Worst Rate

All comparizon were carried out on same frequency and measurement factors.

Maximum Peak Output Power

Test place	Head Office EMC Lab. No.6 Measurement Room
Report No.	31HE0184-HO-02
Date	06/11/2011
Temperature/ Humidity	24deg. C / 52% RH
Engineer	Takayuki Shimada
Mode	11n-20 Tx

11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	-6.55	1.67	9.97	5.09	3.23	30.00	1000	24.91
2437	-6.61	1.68	9.97	5.04	3.19	30.00	1000	24.96
2462	-6.63	1.68	9.97	5.02	3.18	30.00	1000	24.98

Sample Calculation:

Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator

2437MHz

Rate [MCS]	Reading [dBm]	Remark
0	-6.61	*
1	-7.01	
2	-7.21	
3	-7.72	
4	-8.00	
5	-8.32	
6	-8.80	
7	-8.59	

*: Worst Rate

All comparizon were carried out on same frequency and measurement factors.

Radiated Spurious Emission

Test place Head Office EMC Lab. No.3 Semi Anechoic Chamber
Report No. 31HE0184-HO-02
Date 06/16/2011 06/17/2011 06/19/2011
Temperature/ Humidity 24deg. C / 61% RH 23deg. C / 65% RH 24deg. C / 58% RH
Engineer Takayuki Shimada Takayuki Shimada Tomohisa Nakagawa
(1-10GHz) (10-26.5GHz) (Below 1GHz)
Mode 11b Tx 2412MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	180.120	QP	26.8	15.7	8.9	32.0	19.4	43.5	24.1	
Hori	2332.740	PK	49.0	26.3	2.6	32.7	45.2	73.9	28.7	
Hori	2390.000	PK	44.3	26.4	2.6	32.6	40.7	73.9	33.2	
Hori	2400.000	PK	48.0	26.4	2.6	32.6	44.4	73.9	29.5	
Hori	2492.940	PK	47.4	26.5	2.7	32.6	44.0	73.9	29.9	
Hori	4824.000	PK	42.4	30.4	4.4	31.9	45.3	73.9	28.6	
Hori	7236.000	PK	42.8	35.2	5.3	32.4	50.9	73.9	23.0	
Hori	9648.000	PK	43.5	38.1	6.2	32.9	54.9	73.9	19.0	
Hori	24120.000	PK	46.4	38.6	-1.0	31.6	52.4	73.9	21.5	
Hori	2332.740	AV	41.6	26.3	2.6	32.7	37.8	53.9	16.1	
Hori	2390.000	AV	32.1	26.4	2.6	32.6	28.5	53.9	25.4	
Hori	2400.000	AV	37.2	26.4	2.6	32.6	33.6	53.9	20.3	
Hori	2492.940	AV	38.3	26.5	2.7	32.6	34.9	53.9	19.0	
Hori	4824.000	AV	29.5	30.4	4.4	31.9	32.4	53.9	21.5	
Hori	7236.000	AV	30.7	35.2	5.3	32.4	38.8	53.9	15.1	
Hori	9648.000	AV	29.9	38.1	6.2	32.9	41.3	53.9	12.6	
Hori	24120.000	AV	32.0	38.6	-1.0	31.6	38.0	53.9	15.9	
Vert	180.120	QP	29.4	15.7	8.9	32.0	22.0	43.5	21.5	
Vert	2332.740	PK	48.3	26.3	2.6	32.7	44.5	73.9	29.4	
Vert	2390.000	PK	43.5	26.4	2.6	32.6	39.9	73.9	34.0	
Vert	2400.000	PK	47.8	26.4	2.6	32.6	44.2	73.9	29.7	
Vert	2492.940	PK	45.8	26.5	2.7	32.6	42.4	73.9	31.5	
Vert	4824.000	PK	42.6	30.4	4.4	31.9	45.5	73.9	28.4	
Vert	7236.000	PK	42.9	35.2	5.3	32.4	51.0	73.9	22.9	
Vert	9648.000	PK	43.3	38.1	6.2	32.9	54.7	73.9	19.2	
Vert	24120.000	PK	46.3	38.6	-1.0	31.6	52.3	73.9	21.6	
Vert	2332.740	AV	40.3	26.3	2.6	32.7	36.5	53.9	17.4	
Vert	2390.000	AV	32.0	26.4	2.6	32.6	28.4	53.9	25.5	
Vert	2400.000	AV	36.4	26.4	2.6	32.6	32.8	53.9	21.1	
Vert	2492.940	AV	35.7	26.5	2.7	32.6	32.3	53.9	21.6	
Vert	4824.000	AV	29.5	30.4	4.4	31.9	32.4	53.9	21.5	
Vert	7236.000	AV	30.7	35.2	5.3	32.4	38.8	53.9	15.1	
Vert	9648.000	AV	29.9	38.1	6.2	32.9	41.3	53.9	12.6	
Vert	24120.000	AV	32.0	38.6	-1.0	31.6	38.0	53.9	15.9	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

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

*The 10th harmonic was not seen so the result was its base noise level.
Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB
26.5GHz-40GHz 20log(3.0m/0.5m)=15.6dB

Radiated Spurious Emission

Test place Head Office EMC Lab. No.3 Semi Anechoic Chamber
Report No. 31HE0184-HO-02
Date 06/17/2011 06/17/2011 06/19/2011
Temperature/ Humidity 23deg. C / 65% RH 23deg. C / 65% RH 24deg. C / 58% RH
Engineer Takayuki Shimada Takayuki Shimada Tomohisa Nakagawa
(1-26.5GHz) (10-26.5GHz) (Below 1GHz)
Mode 11n-20 Tx 2462MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	180.120	QP	30.3	15.7	8.9	32.0	22.9	43.5	20.6	
Hori	2383.180	PK	47.4	26.4	2.6	32.6	43.8	73.9	30.1	
Hori	2483.500	PK	51.2	26.5	2.7	32.6	47.8	73.9	26.1	
Hori	2540.700	PK	44.9	26.6	2.7	32.5	41.7	73.9	32.2	
Hori	4924.000	PK	42.5	30.5	4.5	31.9	45.6	73.9	28.3	
Hori	7386.000	PK	43.8	35.2	5.3	32.4	51.9	73.9	22.0	
Hori	9848.000	PK	43.5	38.5	6.2	32.9	55.3	73.9	18.6	
Hori	24620.000	PK	47.4	38.9	-1.0	31.3	54.0	73.9	19.9	
Hori	2383.180	AV	35.5	26.4	2.6	32.6	31.9	53.9	22.0	
Hori	2483.500	AV	33.5	26.5	2.7	32.6	30.1	53.9	23.8	
Hori	2540.700	AV	33.4	26.6	2.7	32.5	30.2	53.9	23.7	
Hori	4924.000	AV	29.9	30.5	4.5	31.9	33.0	53.9	20.9	
Hori	7386.000	AV	31.2	35.2	5.3	32.4	39.3	53.9	14.6	
Hori	9848.000	AV	29.8	38.5	6.2	32.9	41.6	53.9	12.3	
Hori	24620.000	AV	32.4	38.9	-1.0	31.3	39.0	53.9	14.9	
Vert	180.120	QP	30.8	15.7	8.9	32.0	23.4	43.5	20.1	
Vert	2383.180	PK	47.0	26.4	2.6	32.6	43.4	73.9	30.5	
Vert	2483.500	PK	50.1	26.5	2.7	32.6	46.7	73.9	27.2	
Vert	2540.700	PK	44.5	26.6	2.7	32.5	41.3	73.9	32.6	
Vert	4924.000	PK	42.4	30.5	4.5	31.9	45.5	73.9	28.4	
Vert	7386.000	PK	43.7	35.2	5.3	32.4	51.8	73.9	22.1	
Vert	9848.000	PK	43.5	38.5	6.2	32.9	55.3	73.9	18.6	
Vert	24620.000	PK	47.4	38.9	-1.0	31.3	54.0	73.9	19.9	
Vert	2383.180	AV	33.8	26.4	2.6	32.6	30.2	53.9	23.7	
Vert	2483.500	AV	32.5	26.5	2.7	32.6	29.1	53.9	24.8	
Vert	2540.700	AV	32.1	26.6	2.7	32.5	28.9	53.9	25.0	
Vert	4924.000	AV	29.9	30.5	4.5	31.9	33.0	53.9	20.9	
Vert	7386.000	AV	31.2	35.2	5.3	32.4	39.3	53.9	14.6	
Vert	9848.000	AV	29.8	38.5	6.2	32.9	41.6	53.9	12.3	
Vert	24620.000	AV	32.4	38.9	-1.0	31.3	39.0	53.9	14.9	

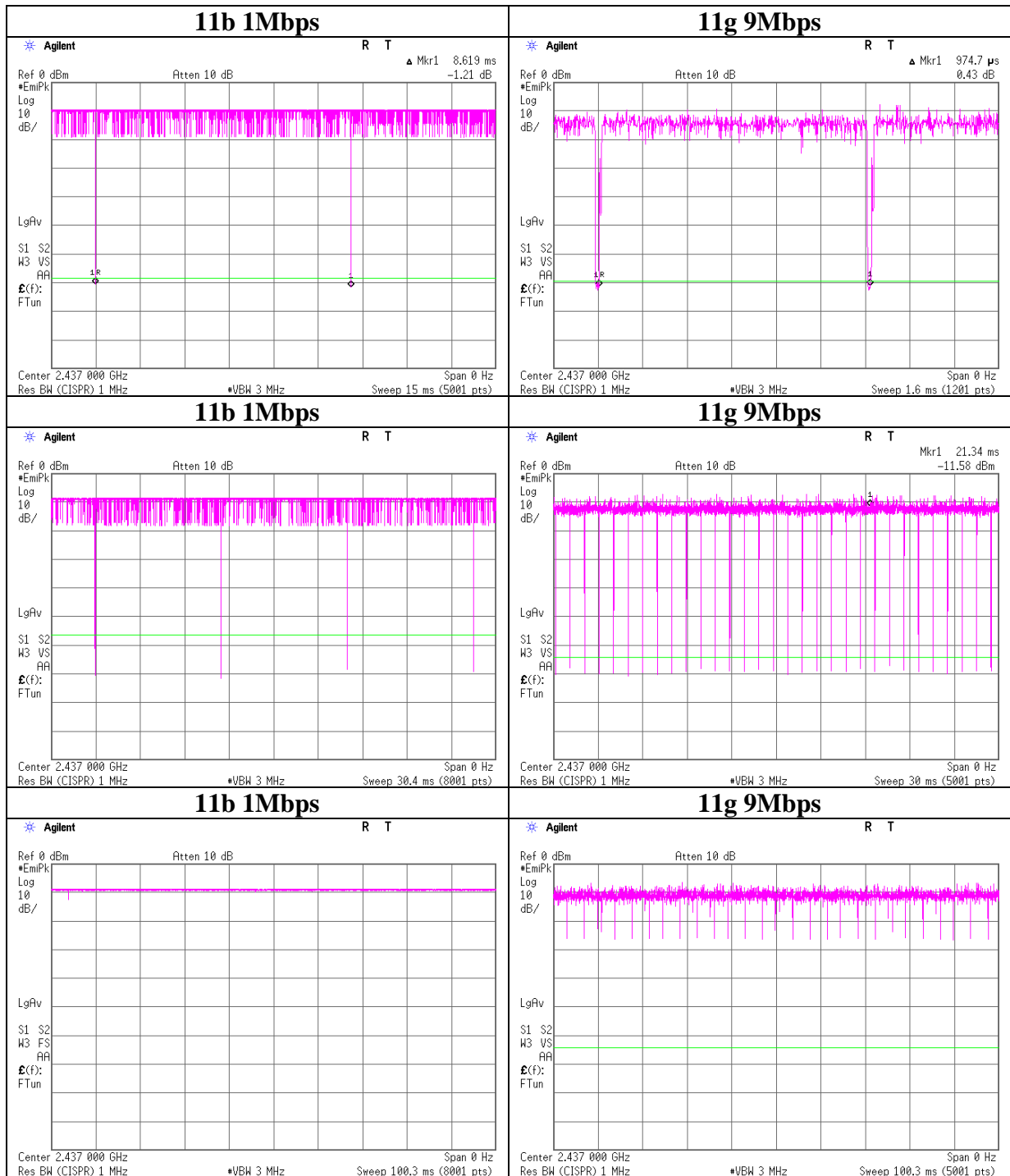
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

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

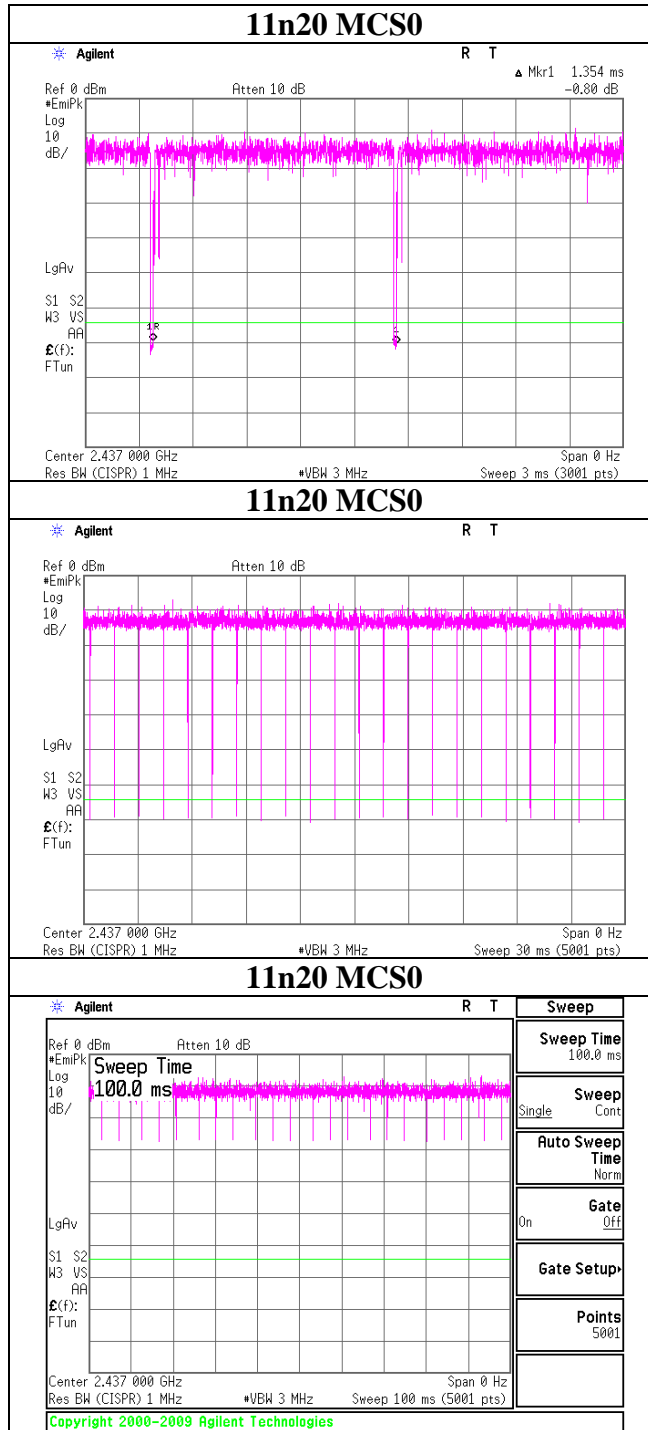
*The 10th harmonic was not seen so the result was its base noise level.

Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB
26.5GHz-40GHz 20log(3.0m/0.5m)=15.6dB

The tested burst timing



The tested burst timing



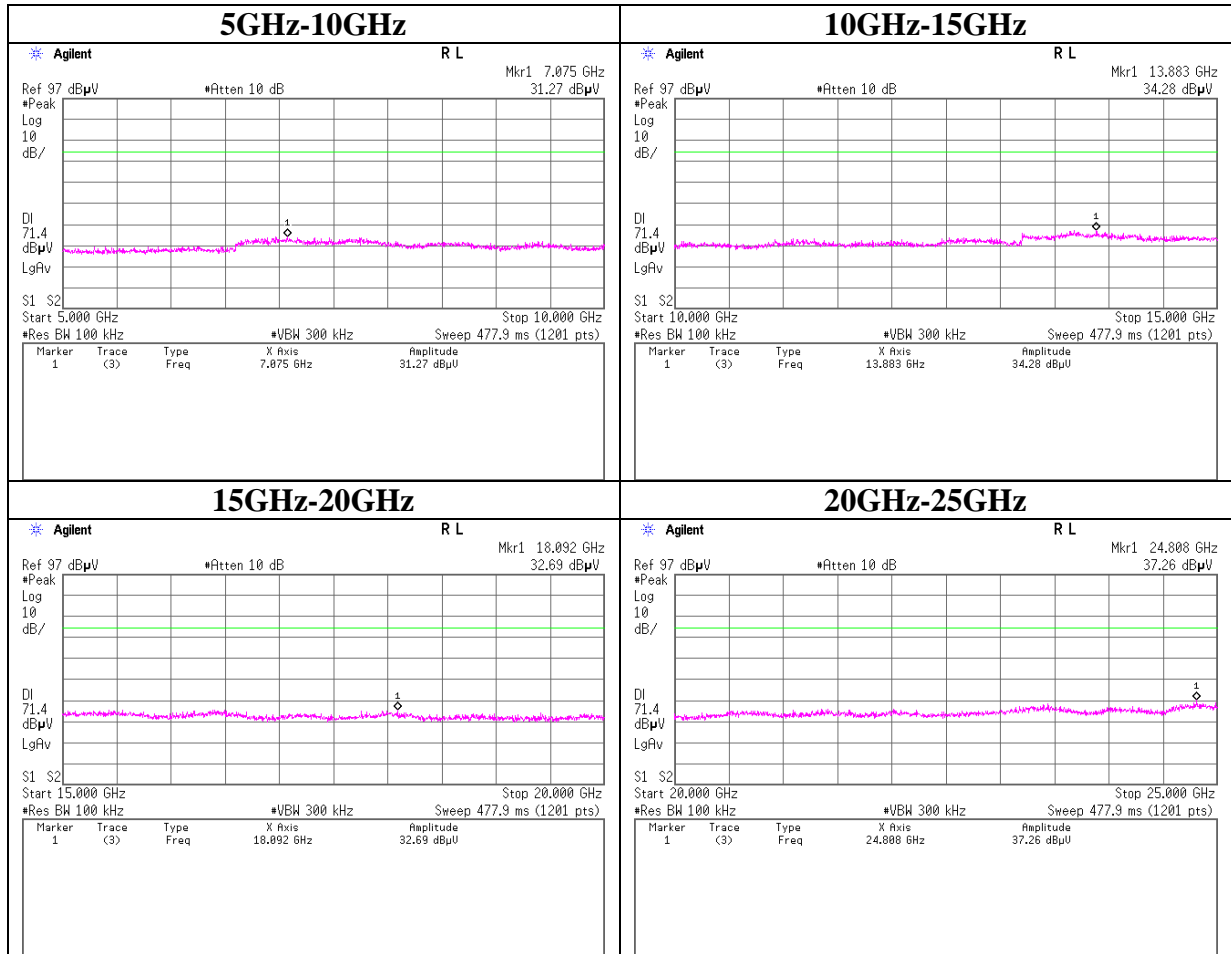
Conducted Spurious Emission

11b Tx 2412MHz



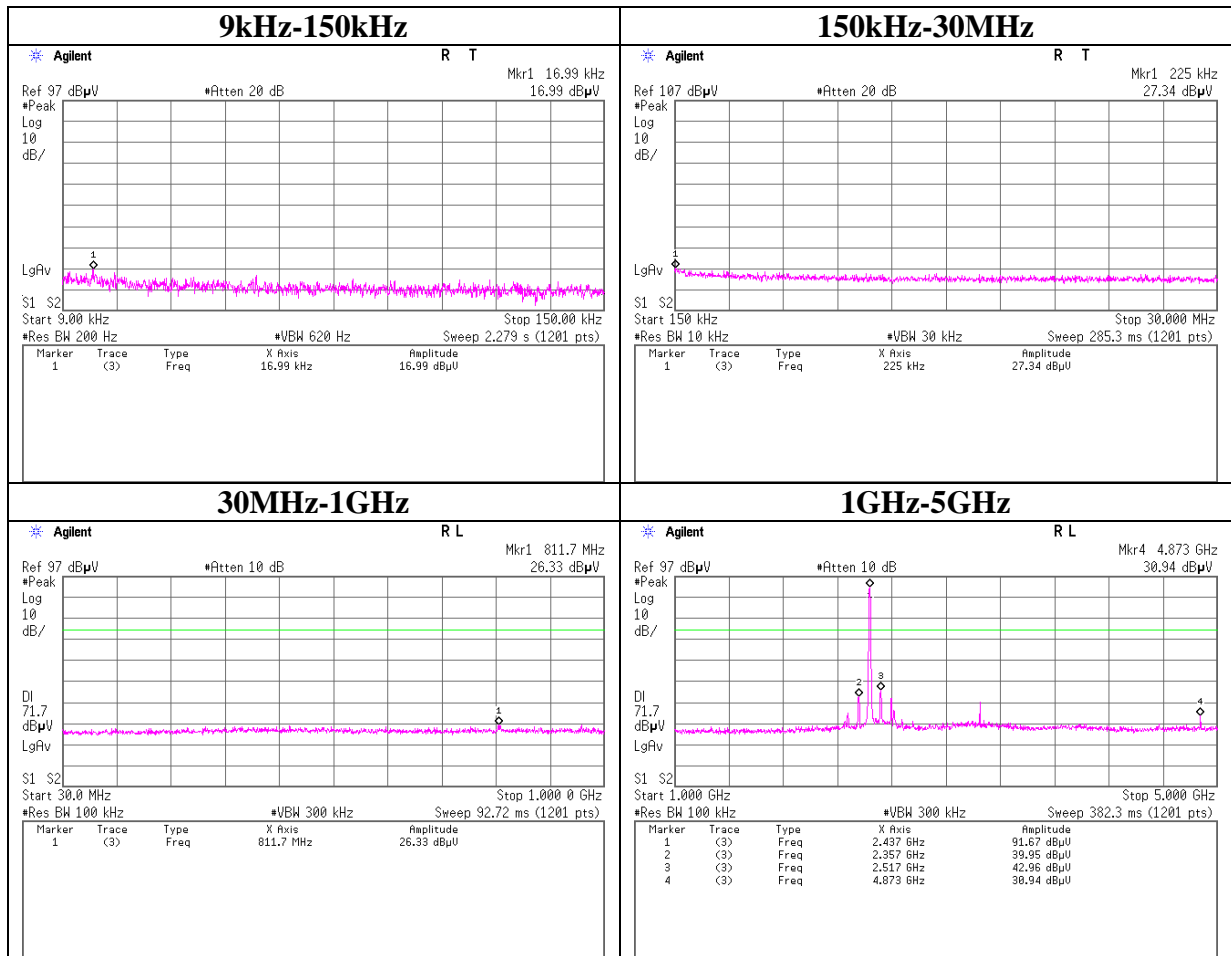
Conducted Spurious Emission

11b Tx 2412MHz



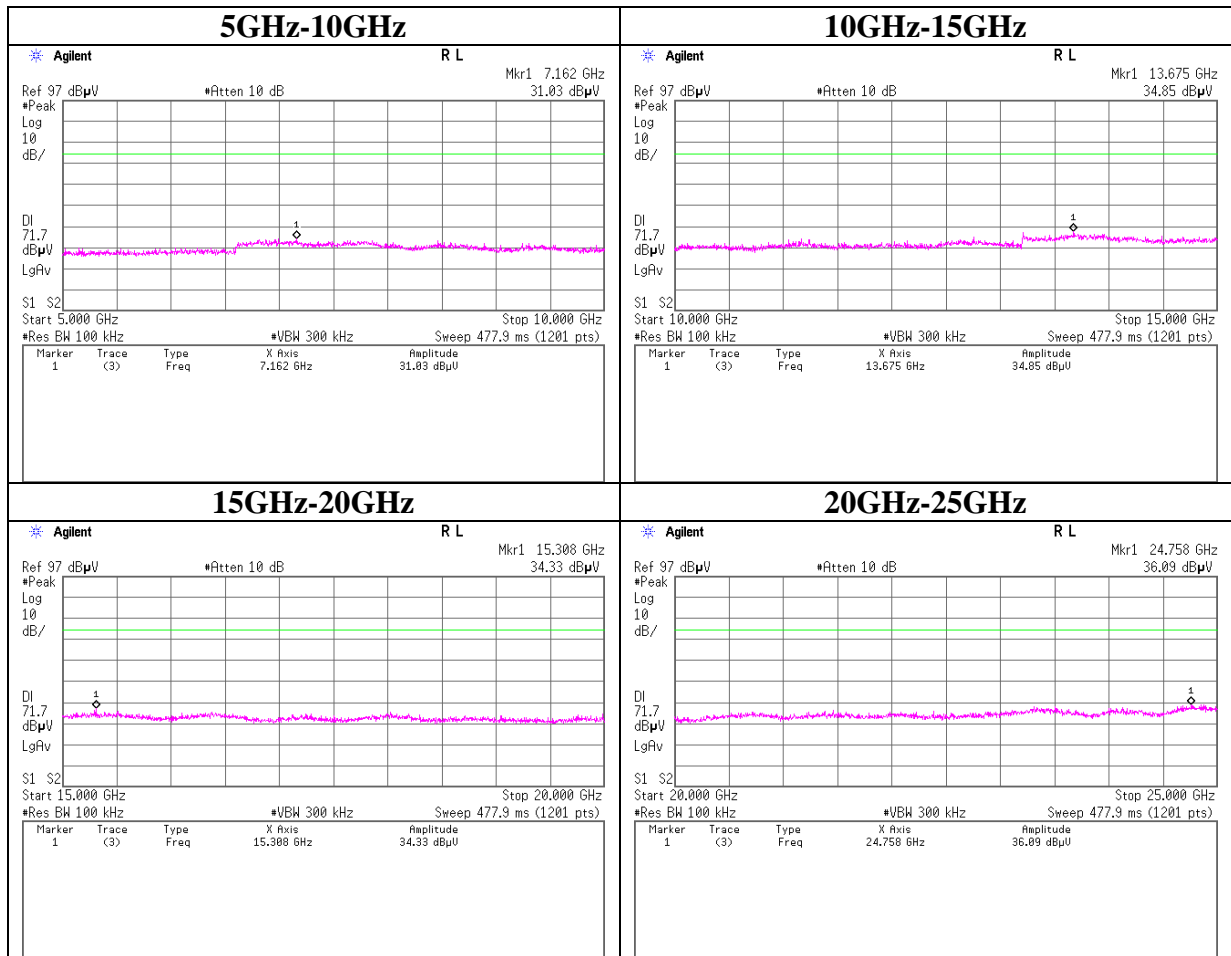
Conducted Spurious Emission

11b Tx 2437MHz



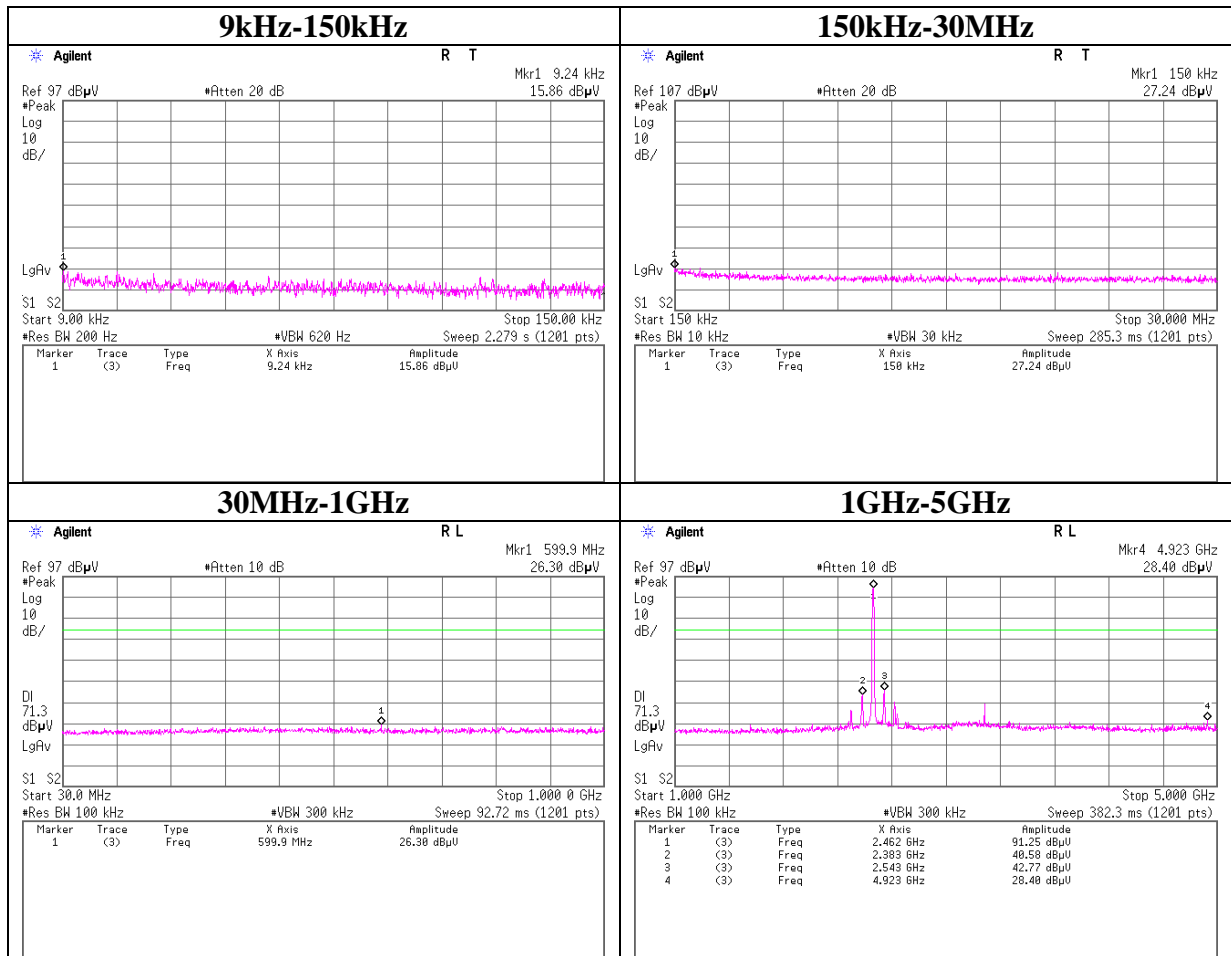
Conducted Spurious Emission

11b Tx 2437MHz



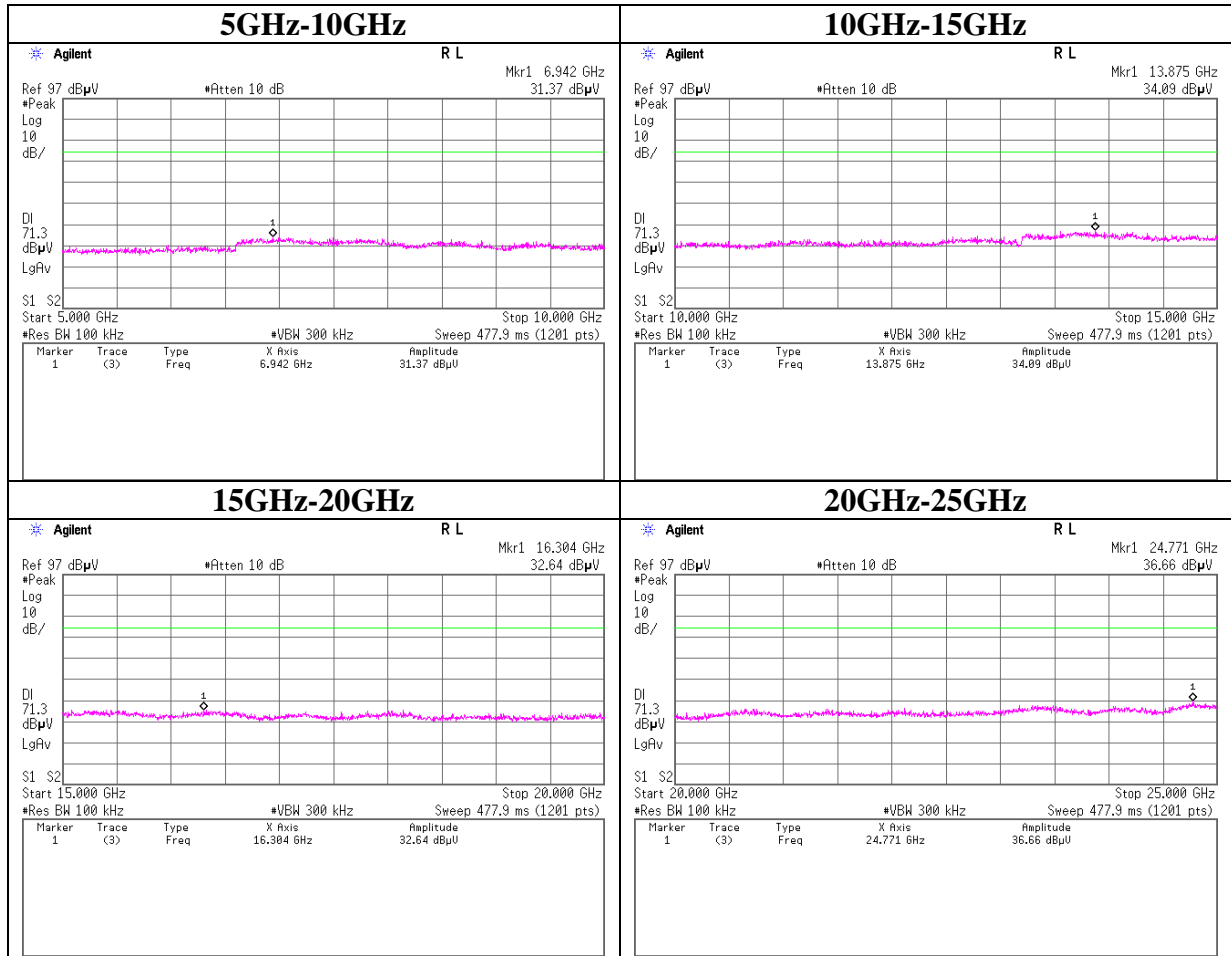
Conducted Spurious Emission

11b Tx 2462MHz



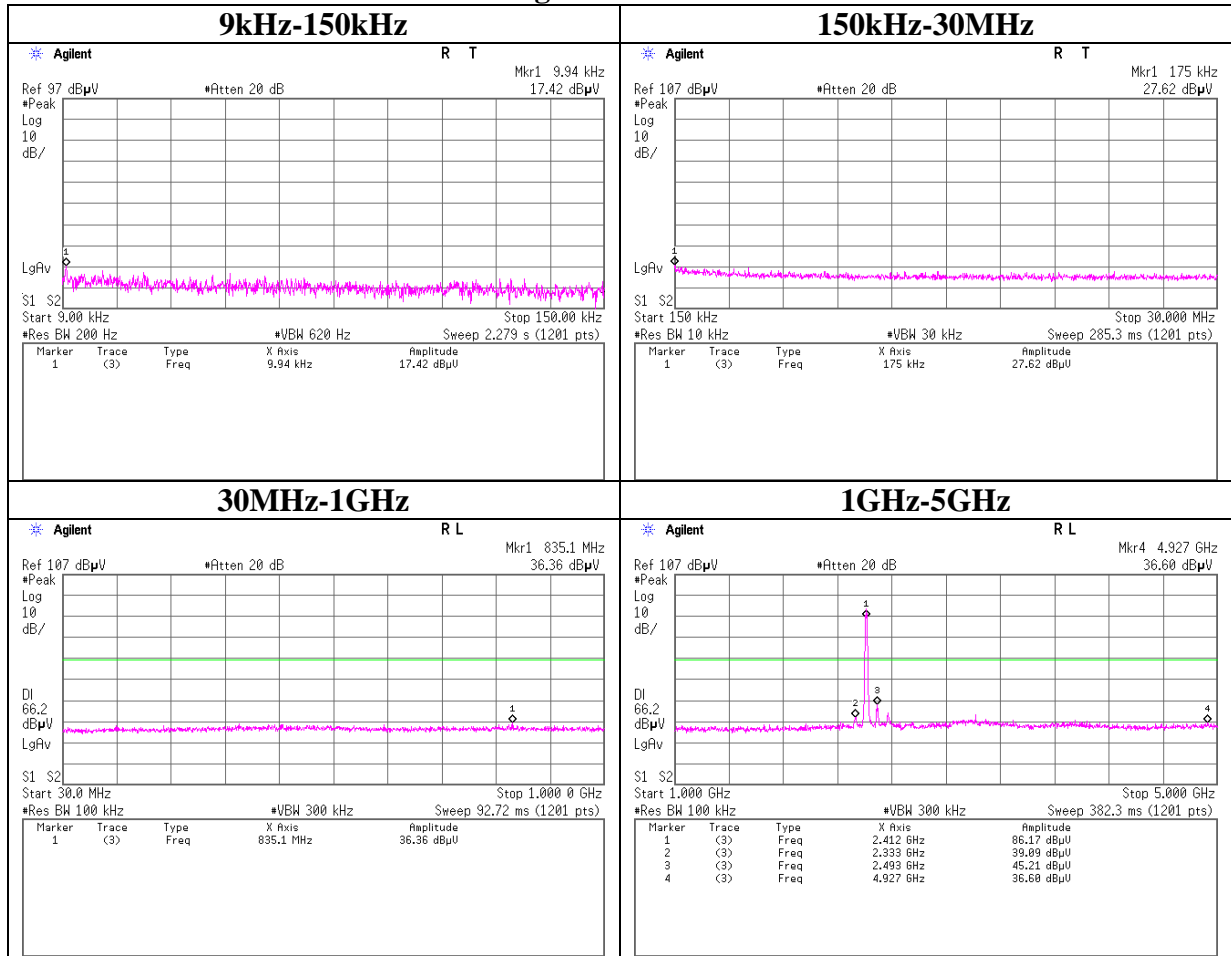
Conducted Spurious Emission

11b Tx 2462MHz



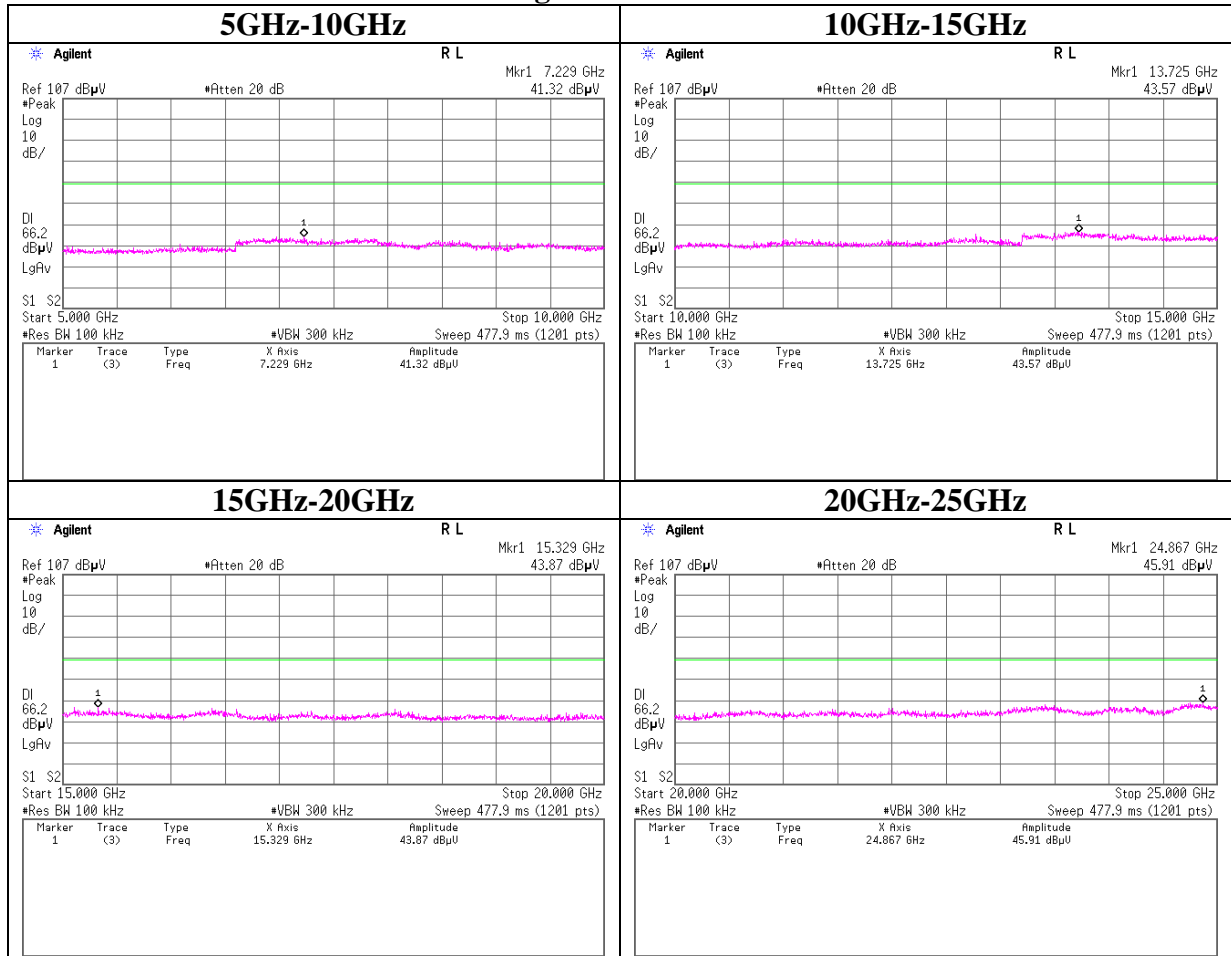
Conducted Spurious Emission

11g Tx 2412MHz



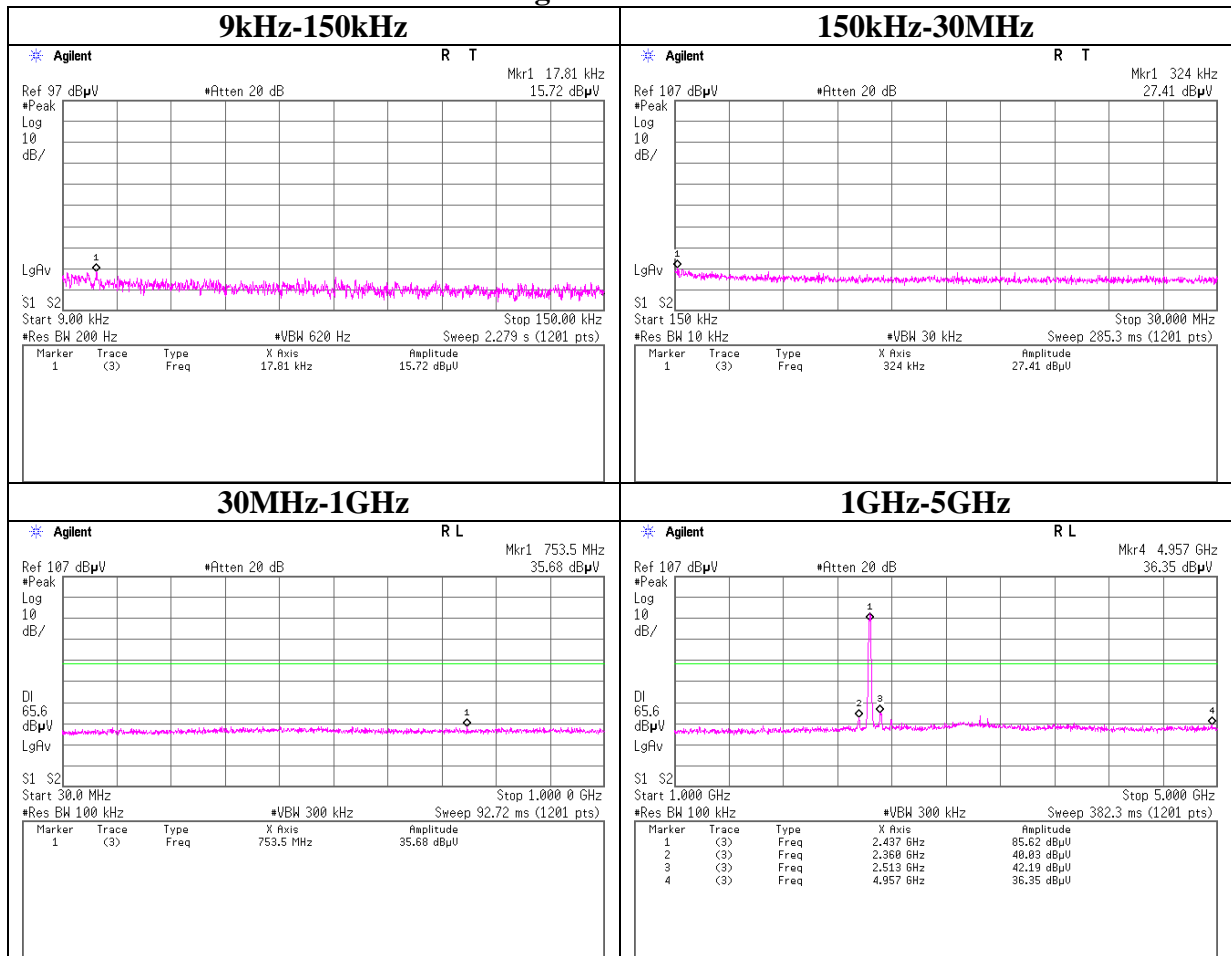
Conducted Spurious Emission

11g Tx 2412MHz



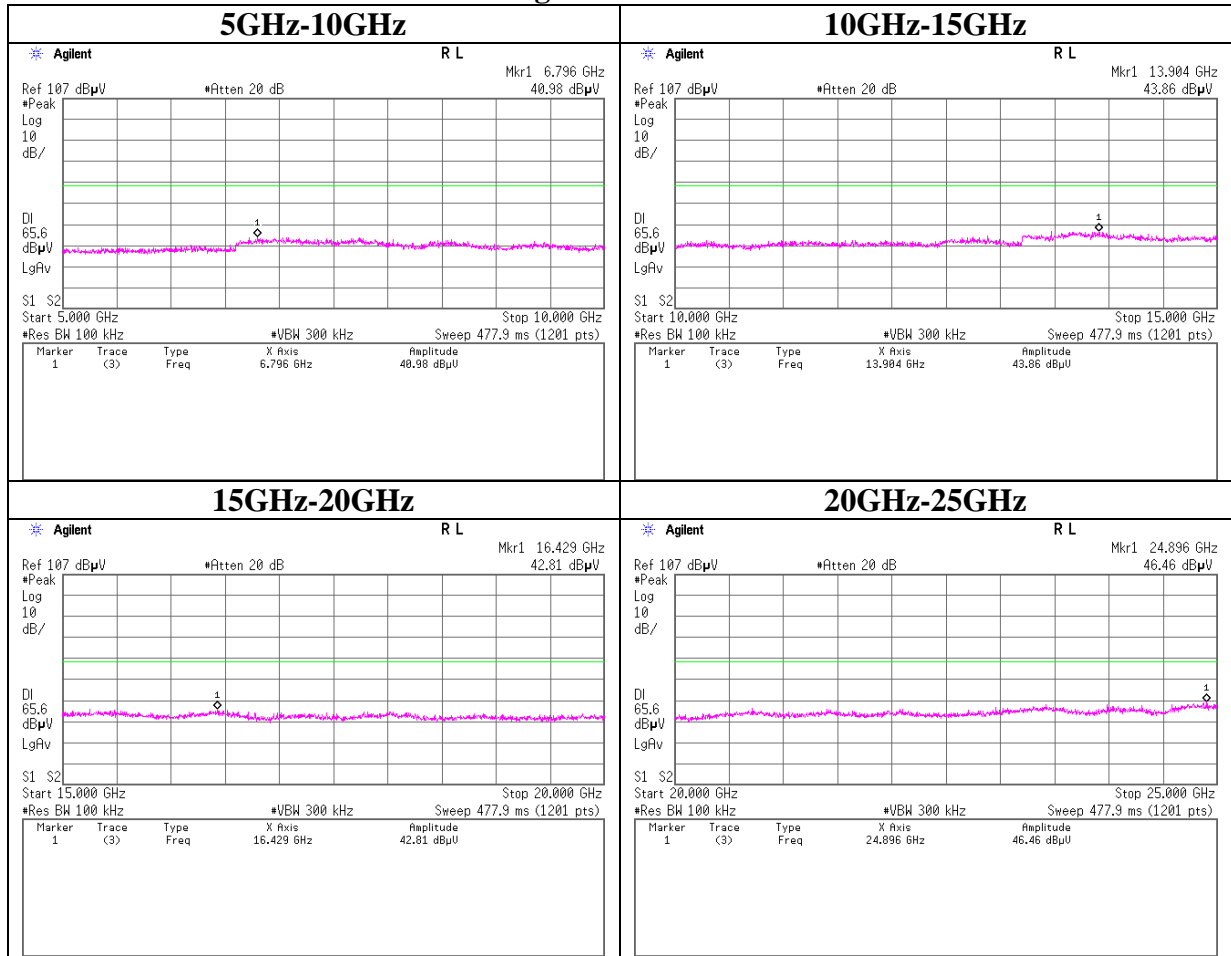
Conducted Spurious Emission

11g Tx 2437MHz



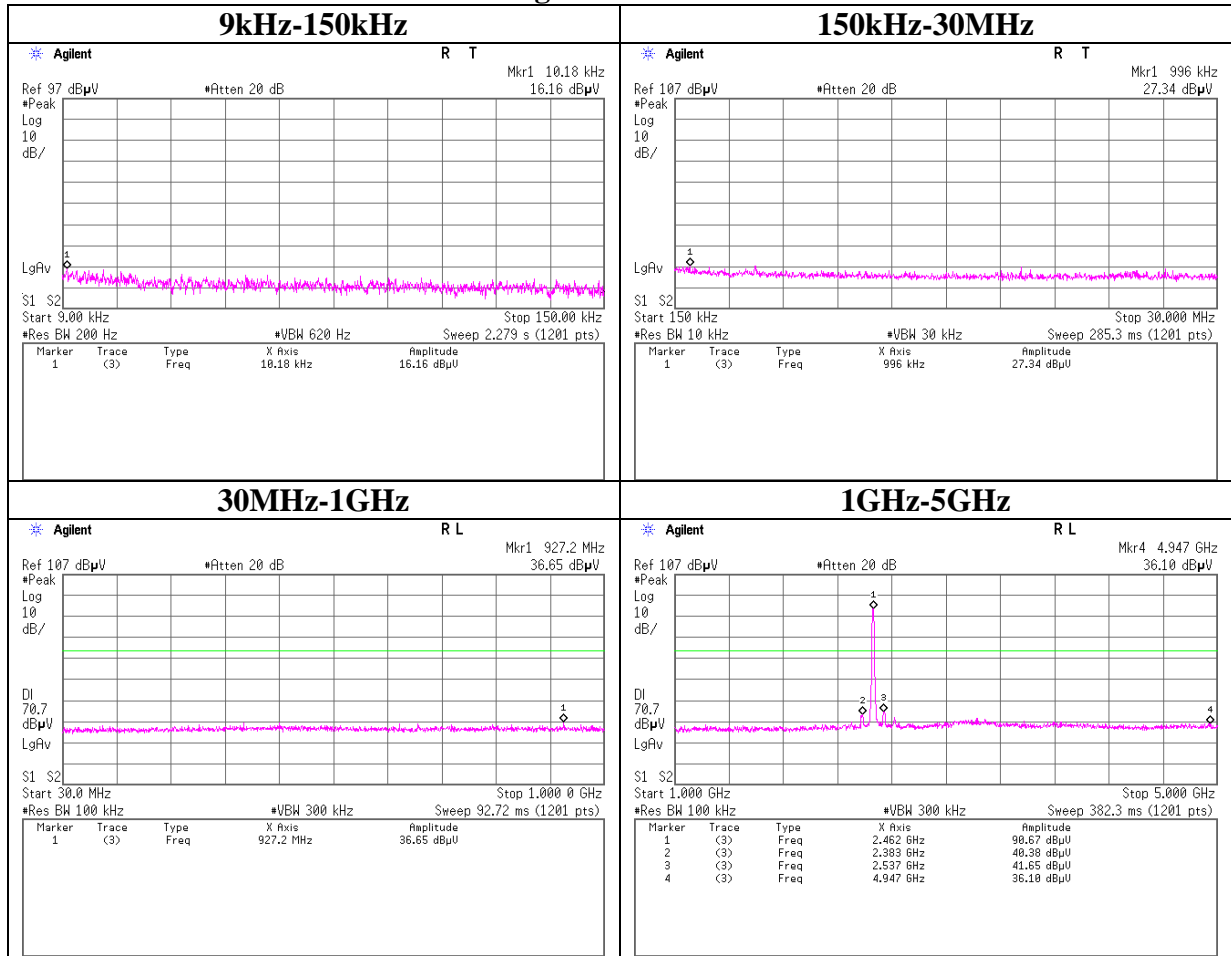
Conducted Spurious Emission

11g Tx 2437MHz



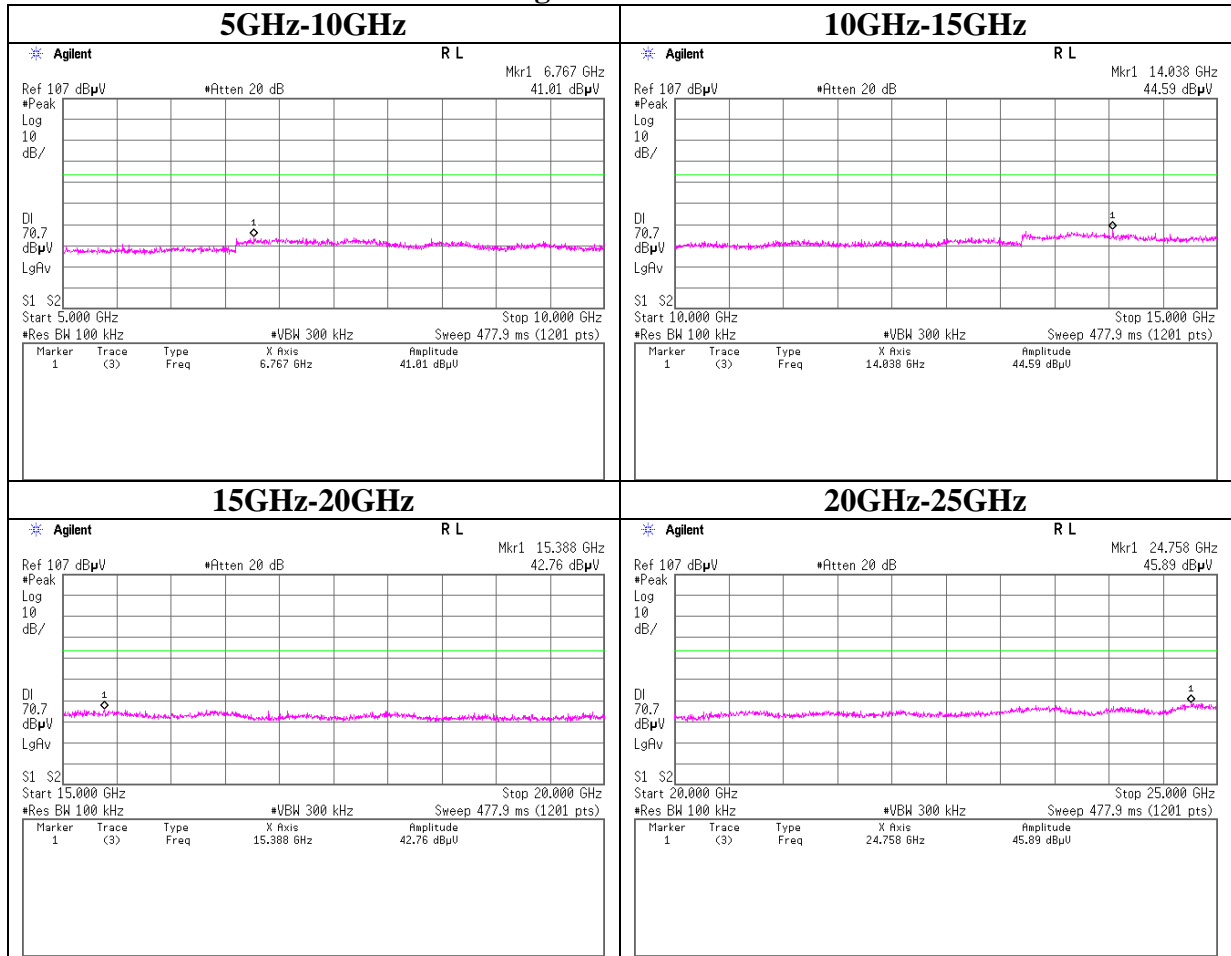
Conducted Spurious Emission

11g Tx 2462MHz



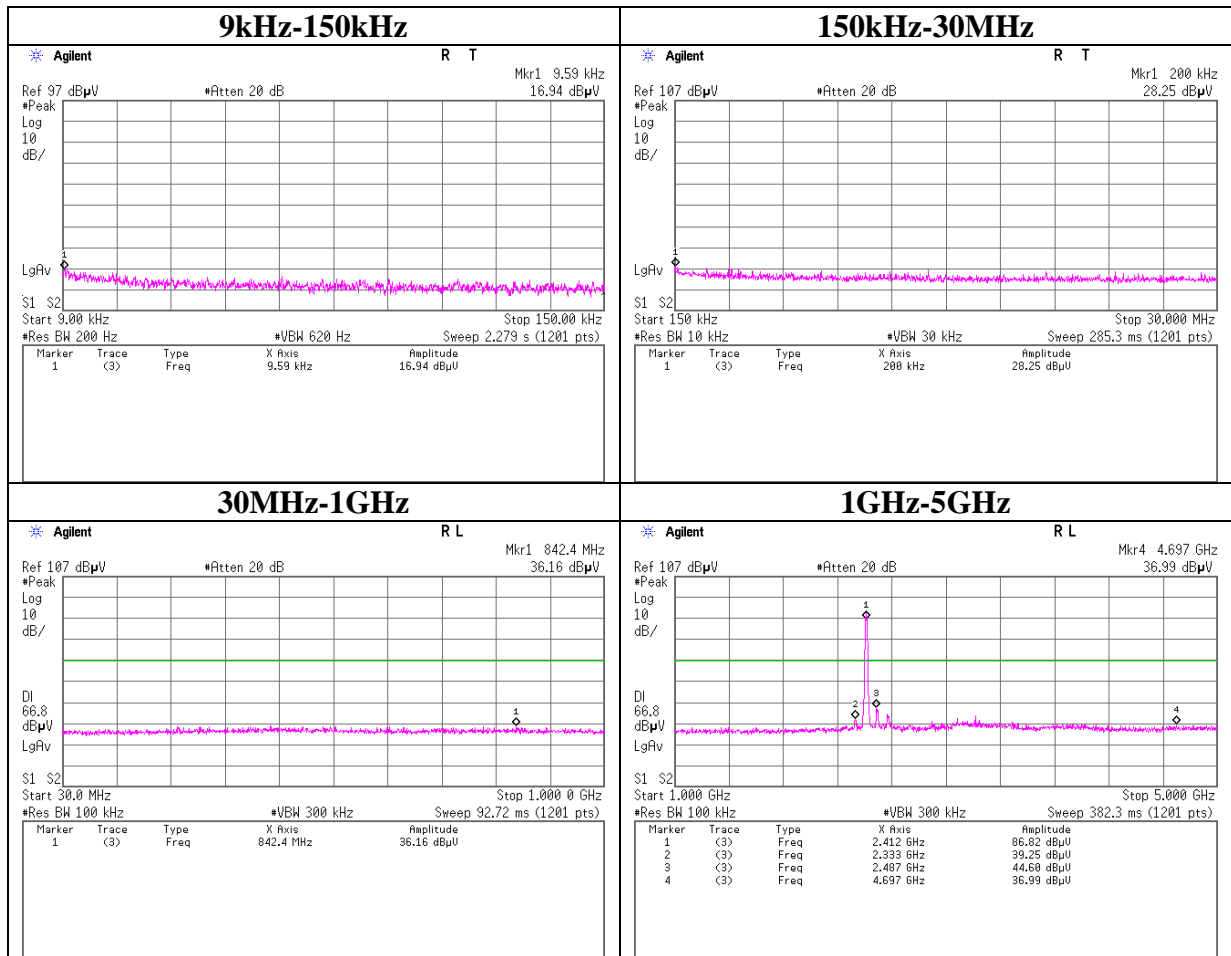
Conducted Spurious Emission

11g Tx 2462MHz



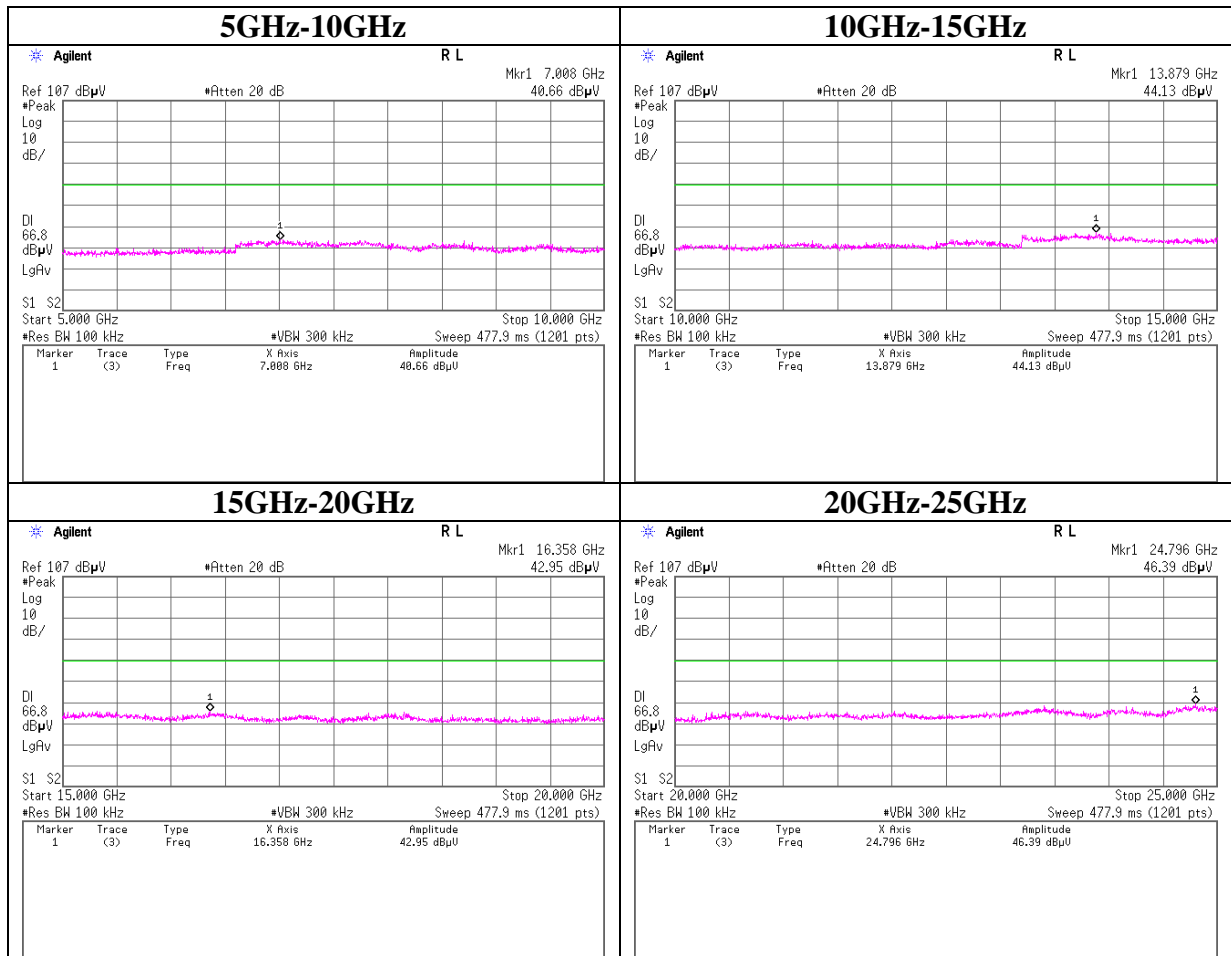
Conducted Spurious Emission

11n-20 Tx 2412MHz



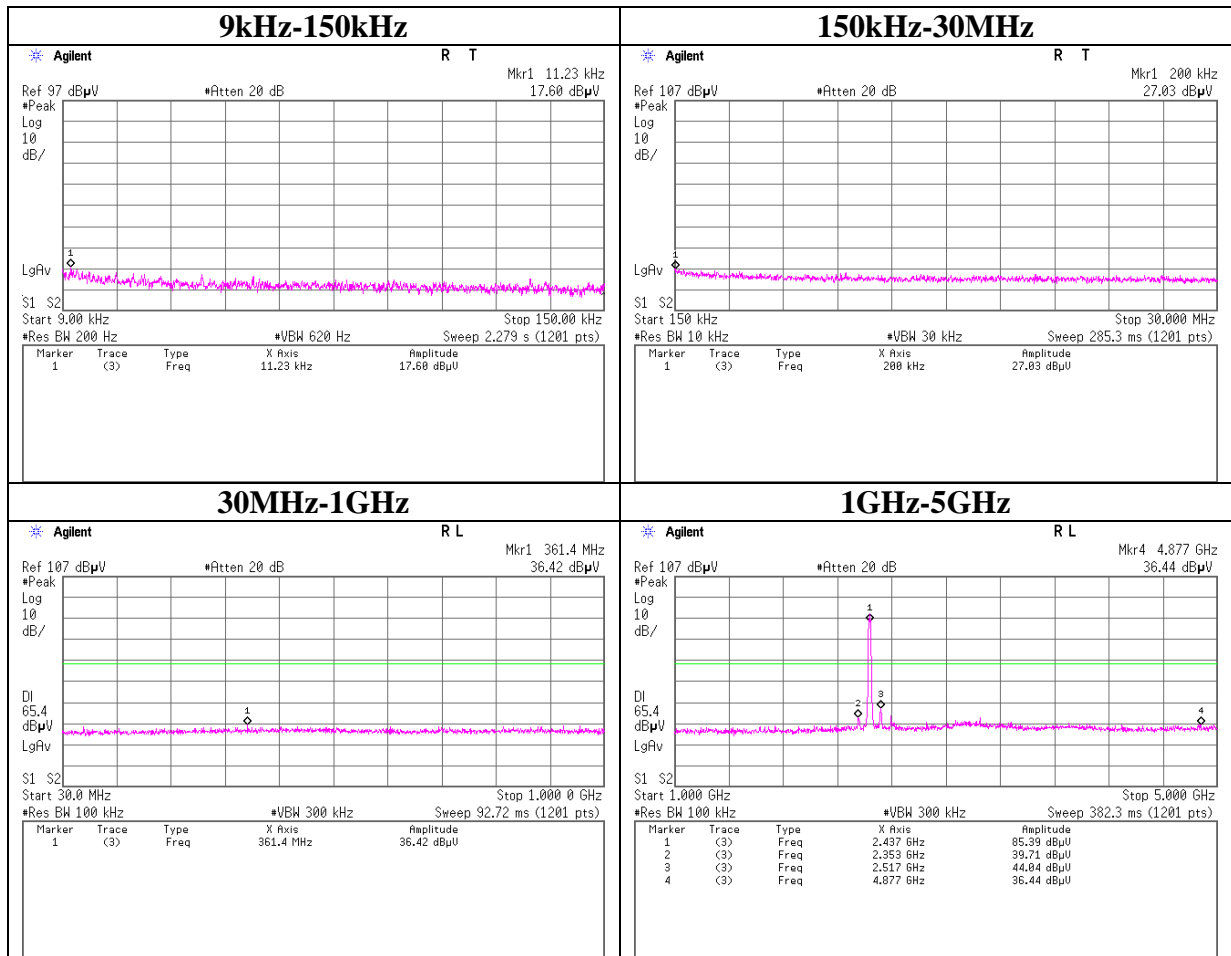
Conducted Spurious Emission

11n-20 Tx 2412MHz



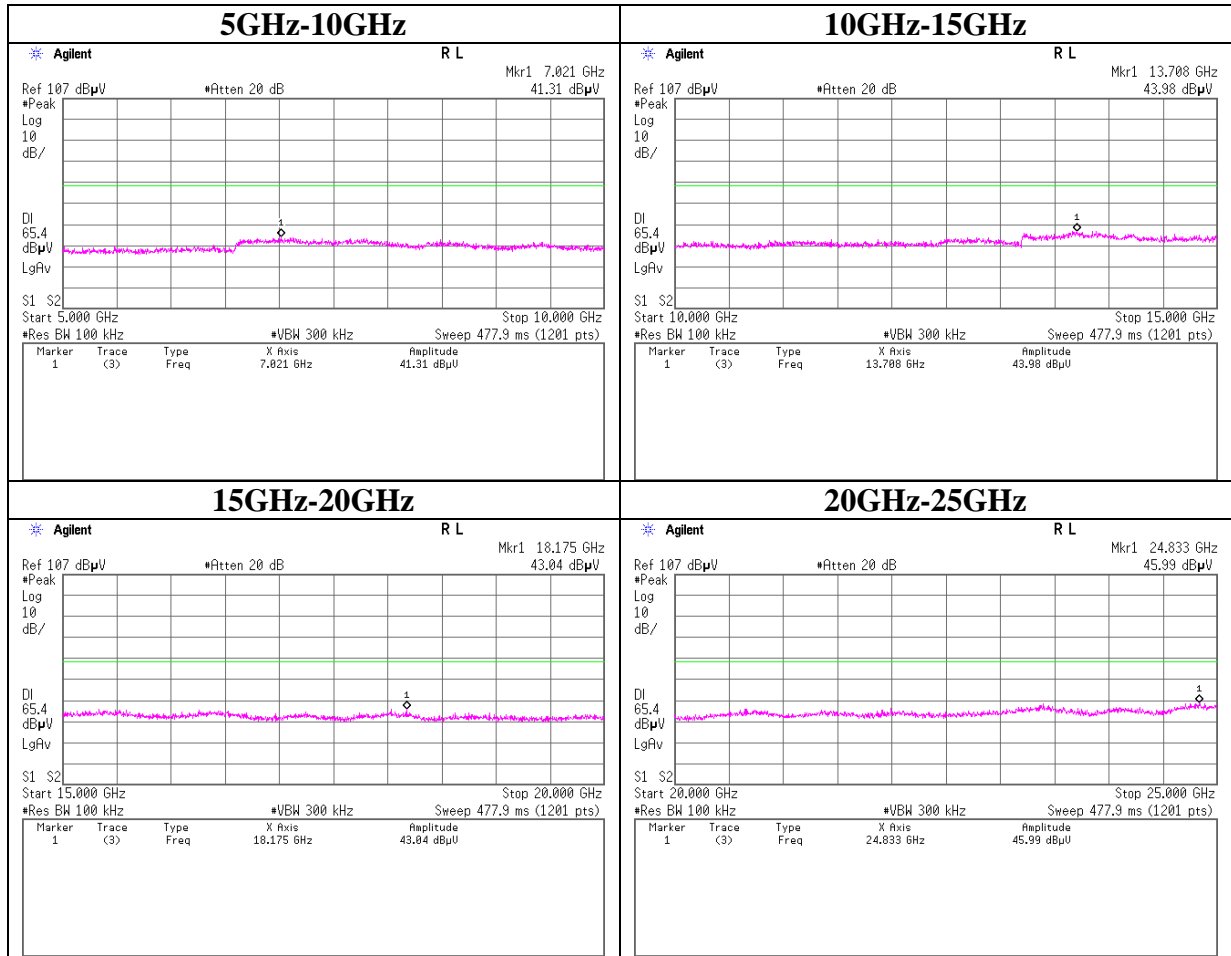
Conducted Spurious Emission

11n-20 Tx 2437MHz



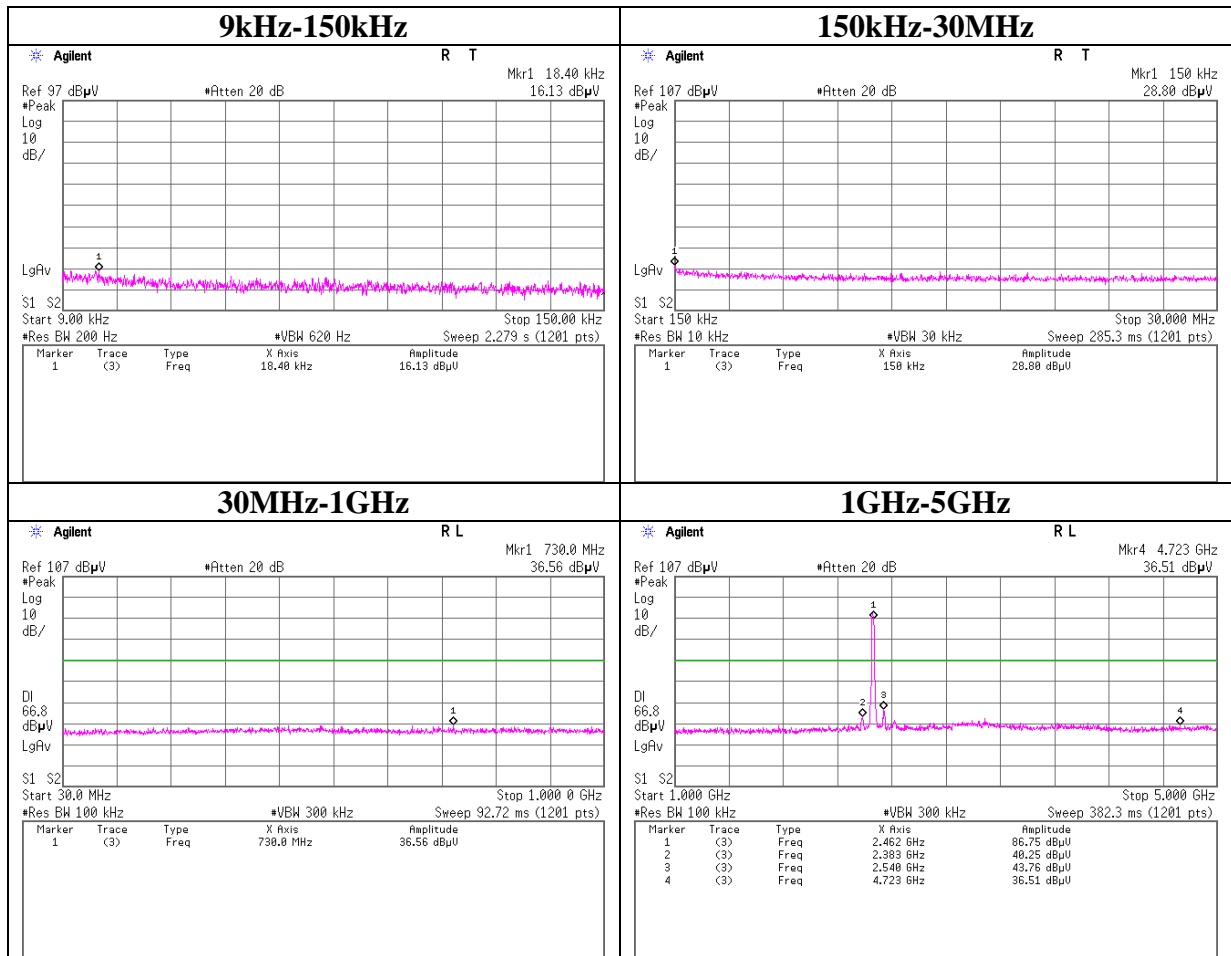
Conducted Spurious Emission

11n-20 Tx 2437MHz



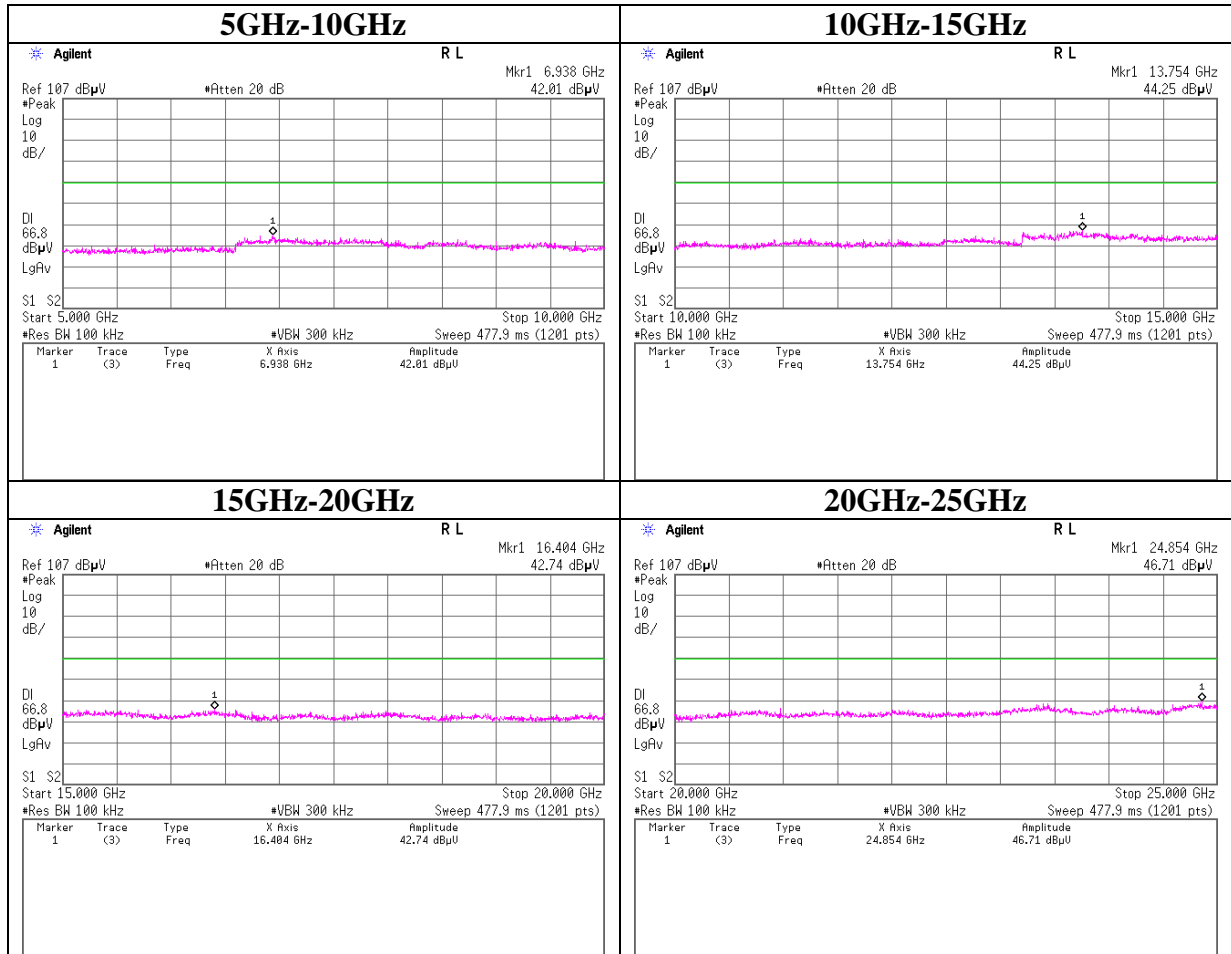
Conducted Spurious Emission

11n-20 Tx 2462MHz



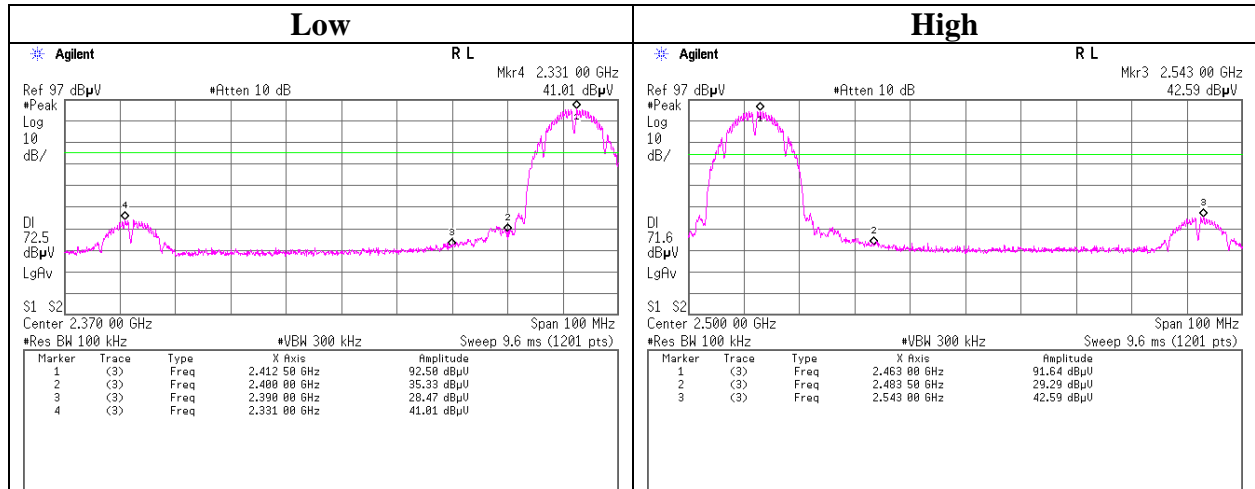
Conducted Spurious Emission

11n-20 Tx 2462MHz

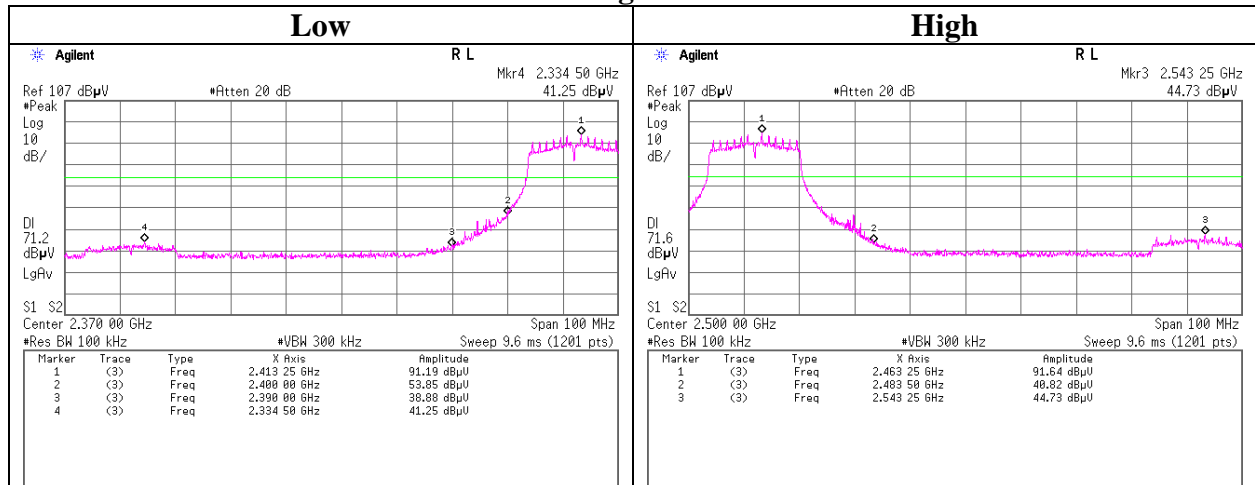


Conducted Emission Band Edge compliance

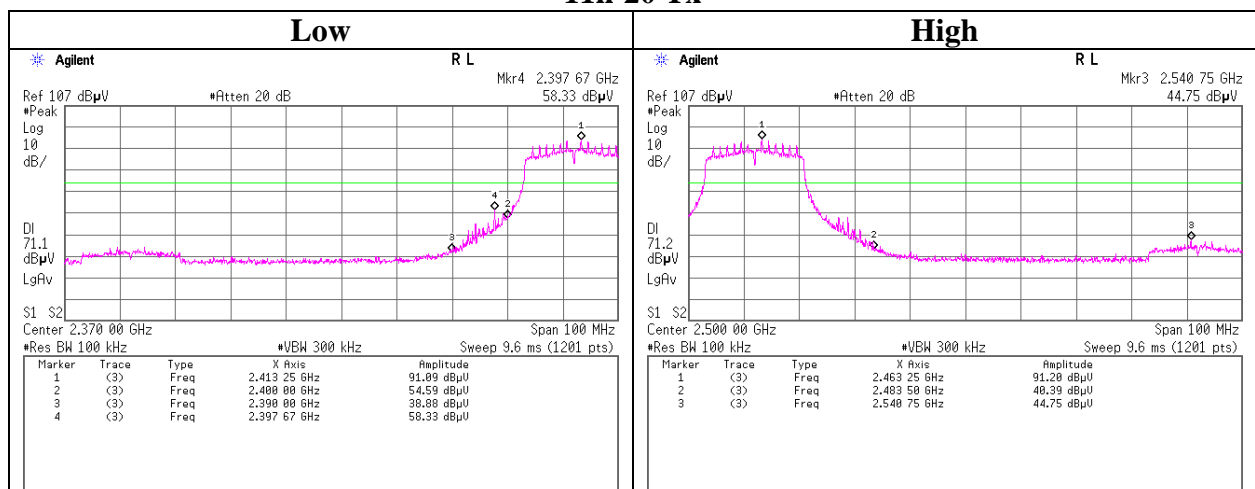
11b Tx



11g Tx



11n-20 Tx



Power Density

Test place Head Office EMC Lab. No.11 Measurement Room
Report No. 31HE0184-HO-02
Date 06/14/2011
Temperature/ Humidity 26 deg.C./ 51%
Engineer Satofumi Matsuyama
Mode 11b Tx, 11g Tx, 11n-20 Tx

11b

Freq.	Reading	Cable Loss	Atten.	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-16.16	0.94	9.97	-5.25	8.00	13.25
2437.00	-16.58	0.95	9.97	-5.66	8.00	13.66
2462.00	-16.74	0.95	9.97	-5.82	8.00	13.82

11g

Freq.	Reading	Cable Loss	Atten.	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-21.10	0.94	9.97	-10.19	8.00	18.19
2437.00	-21.60	0.95	9.97	-10.68	8.00	18.68
2462.00	-20.58	0.95	9.97	-9.66	8.00	17.66

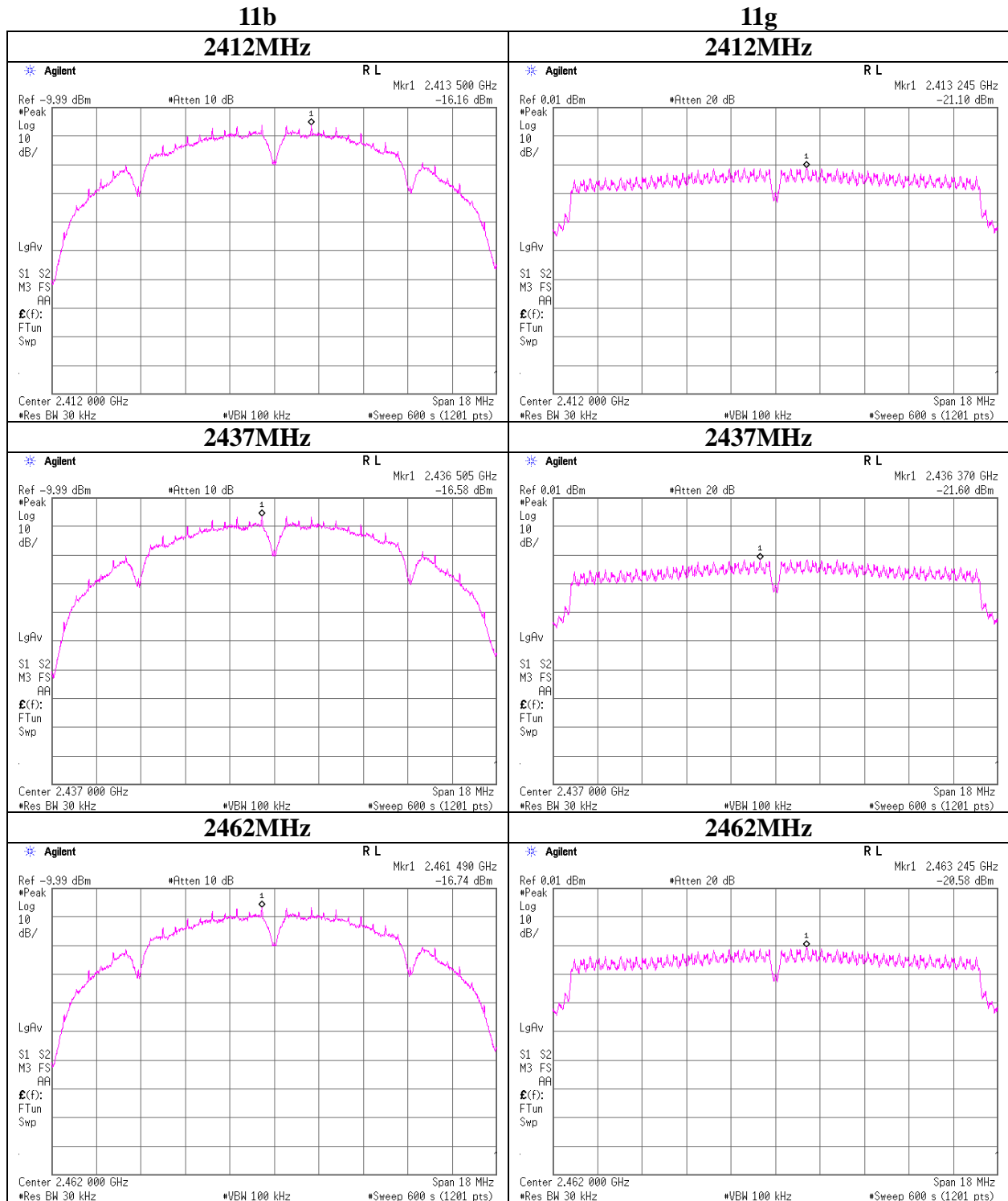
11n-20

Freq.	Reading	Cable Loss	Atten.	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-21.00	0.94	9.97	-10.09	8.00	18.09
2437.00	-22.30	0.95	9.97	-11.38	8.00	19.38
2462.00	-21.34	0.95	9.97	-10.42	8.00	18.42

Sample Calculation:

Result = Reading + Cable Loss + Attenuator

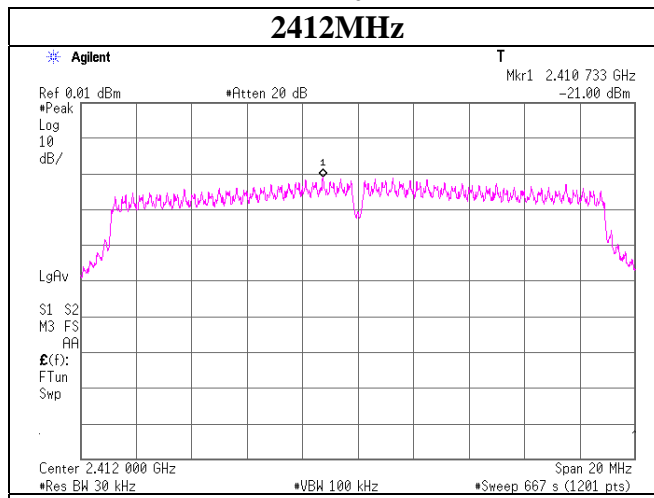
Power Density



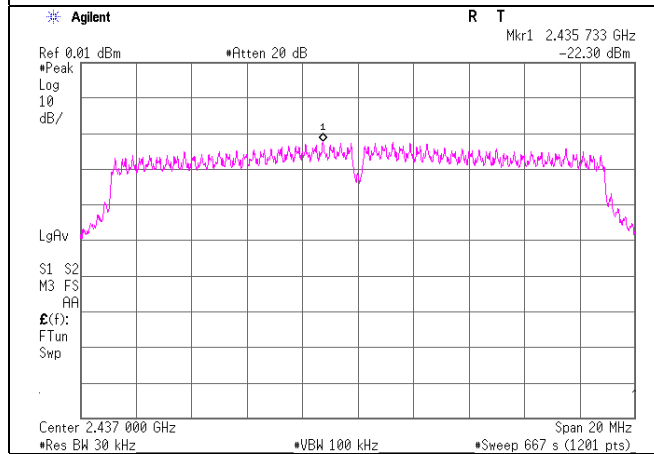
Power Density

11n-20

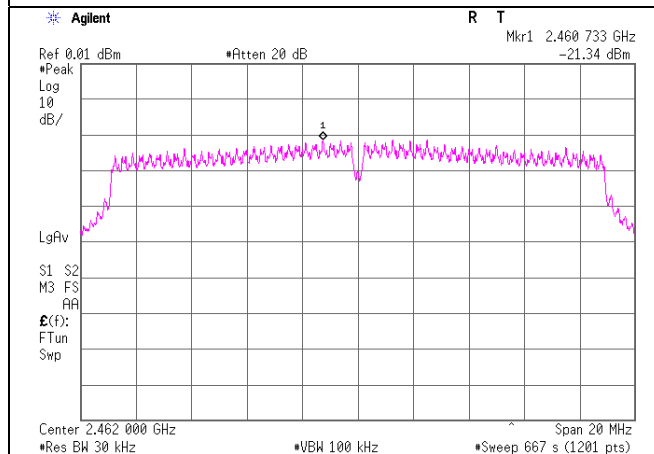
2412MHz



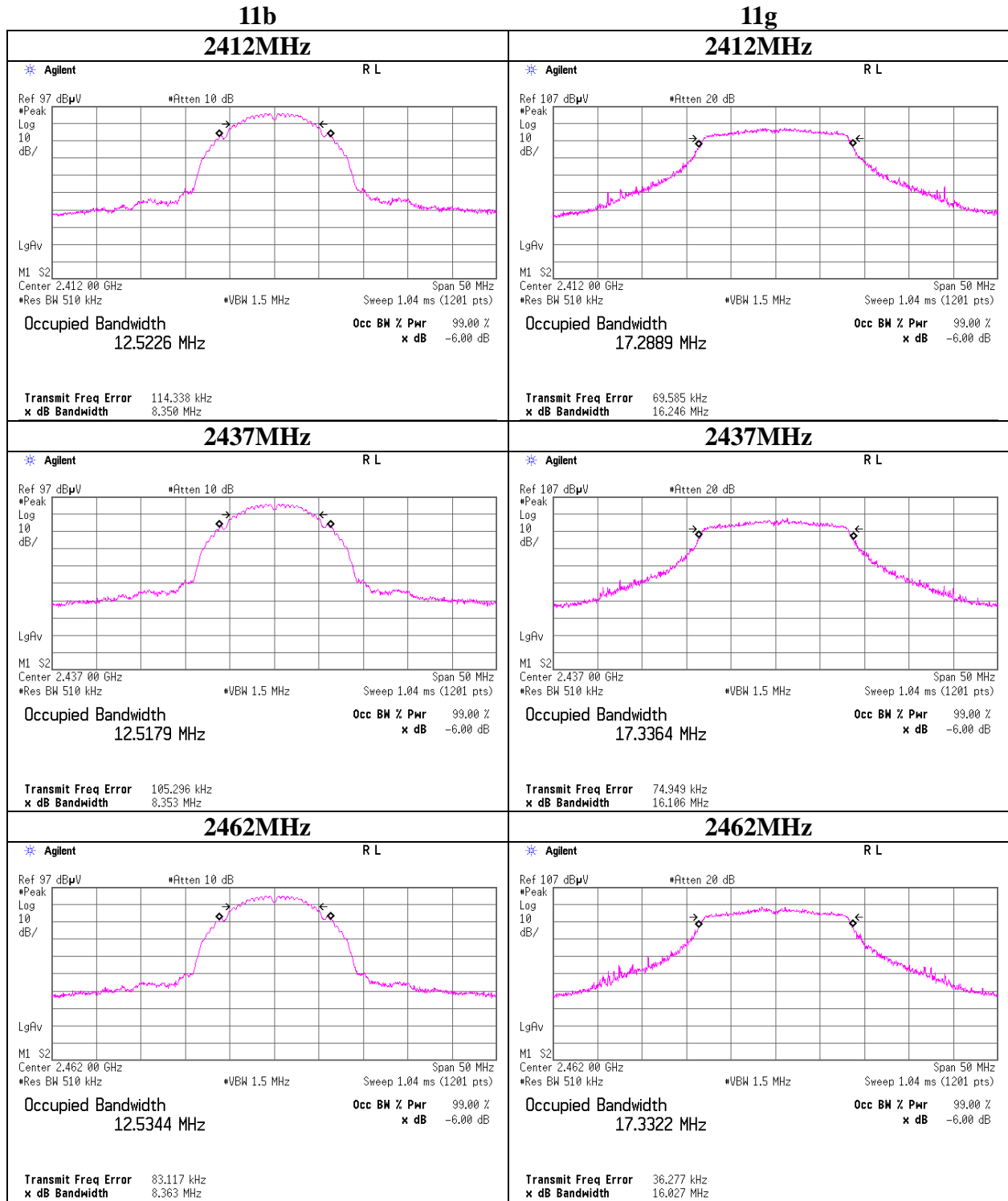
2437MHz



2462MHz



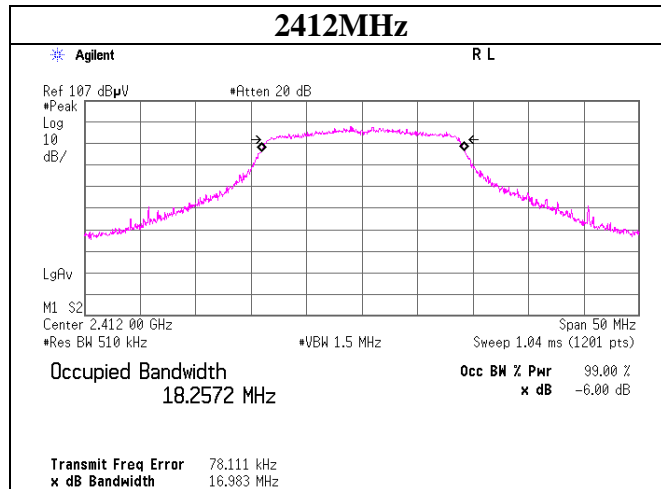
99%Occupied Bandwidth



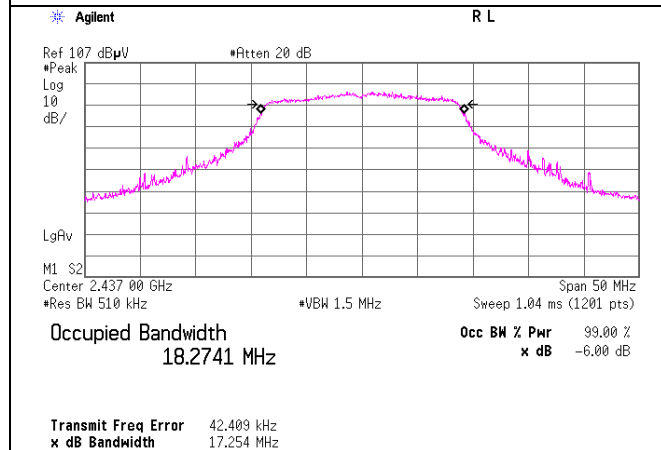
99% Occupied Bandwidth

11n-20

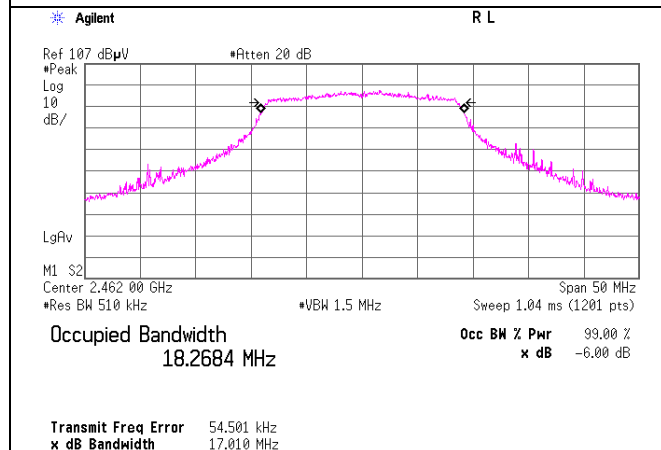
2412MHz



2437MHz



2462MHz



APPENDIX 3: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MOS-14	Thermo-Hygrometer	Custom	CTH-201	-	AT	2011/02/23 * 12
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	AT	2010/11/30 * 12
MPM-08	Power Meter	Anritsu	ML2495A	6K00003338	AT	2010/09/10 * 12
MPSE-11	Power sensor	Anritsu	MA2411B	011737	AT	2010/09/10 * 12
MAT-24	Attenuator(10dB)(above 1GHz)	Agilent	8493C	71389	AT	2010/06/14 * 12
MCC-114	Microwave Cable 1G-26.5GHz	Suhner	SUCOFLEX104	290212/4	AT	2010/08/05 * 12
MOS-19	Thermo-Hygrometer	Custom	CTH-201	0001	AT	2010/12/13 * 12
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	AT/CE	2011/02/15 * 12
MCC-115	Microwave Cable 1G-26.5GHz	Suhner	SUCOFLEX104	290211/4	AT	2010/08/05 * 12
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE/CE	2011/02/22 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	-	RE/CE	2011/02/23 * 12
MJM-15	Measure	KOMELON	KMC-36	-	RE/CE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MSA-05	Spectrum Analyzer	Advantest	R3273	160400285	RE	2010/11/18 * 12
MHA-20	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	RE	2011/05/23 * 12
MCC-18	Microwave Cable 1G-26.5GHz	Suhner	SUCOFLEX 104	148048-143(1m) / 292410(5m)	RE	2010/09/30 * 12
MPA-11	MicroWave System Amplifier	Agilent	83017A	MY39500779	RE	2011/03/10 * 12
MHF-06	High Pass Filter 3.5-24GHz	TOKIMEC	TF323DCA	601	RE	2011/05/16 * 12
MHA-16	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170306	RE	2011/05/23 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE/CE	2010/08/23 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2010/10/11 * 12
MLA-03	Logperiodic Antenna	Schwarzbeck	USLP9143	174	RE	2010/10/11 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2010/07/06 * 12
MAT-09	Attenuator(6dB)	Weinschel Corp	2	BK7973	RE	2010/11/05 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2011/03/04 * 12
MLS-07	LISN(AMN)	Schwarzbeck	NSLK8127	8127364	CE(EUT)	2011/02/22 * 12
MCC-112	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/SFM141(3m)/sucoform141-PE(1m)/421-010(1.5m)/RFM-E321(Switcher)	-/00640	CE	2010/07/23 * 12
MAT-66	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2011/02/22 * 12

The expiration date of the calibration is the end of the expired month.

All equipment is calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

Test Item: CE: Conducted Emission, RE: Radiated Emission
AT: Antenna Terminal Conducted test

UL Japan, Inc.

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