

**APPENDIX 2: Data of EMI test**

**Conducted Emission**

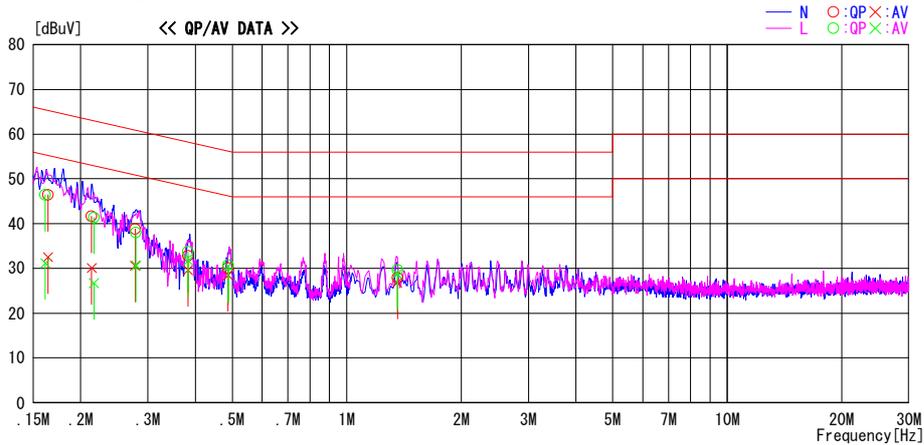
**DATA OF CONDUCTED EMISSION TEST**

UL Japan, Inc. Head Office EMC Lab. No.4 Semi Anechoic Chamber  
Date : 2011/02/18 16:34:21

Report No. : 31GE0056-HO-01  
Temp./Humi. : 22deg. C / 32%  
Engineer : Takumi Shimada

Mode / Remarks : Tx 2441MHz DHS

LIMIT : FCC15.207 QP  
FCC15.207 AV

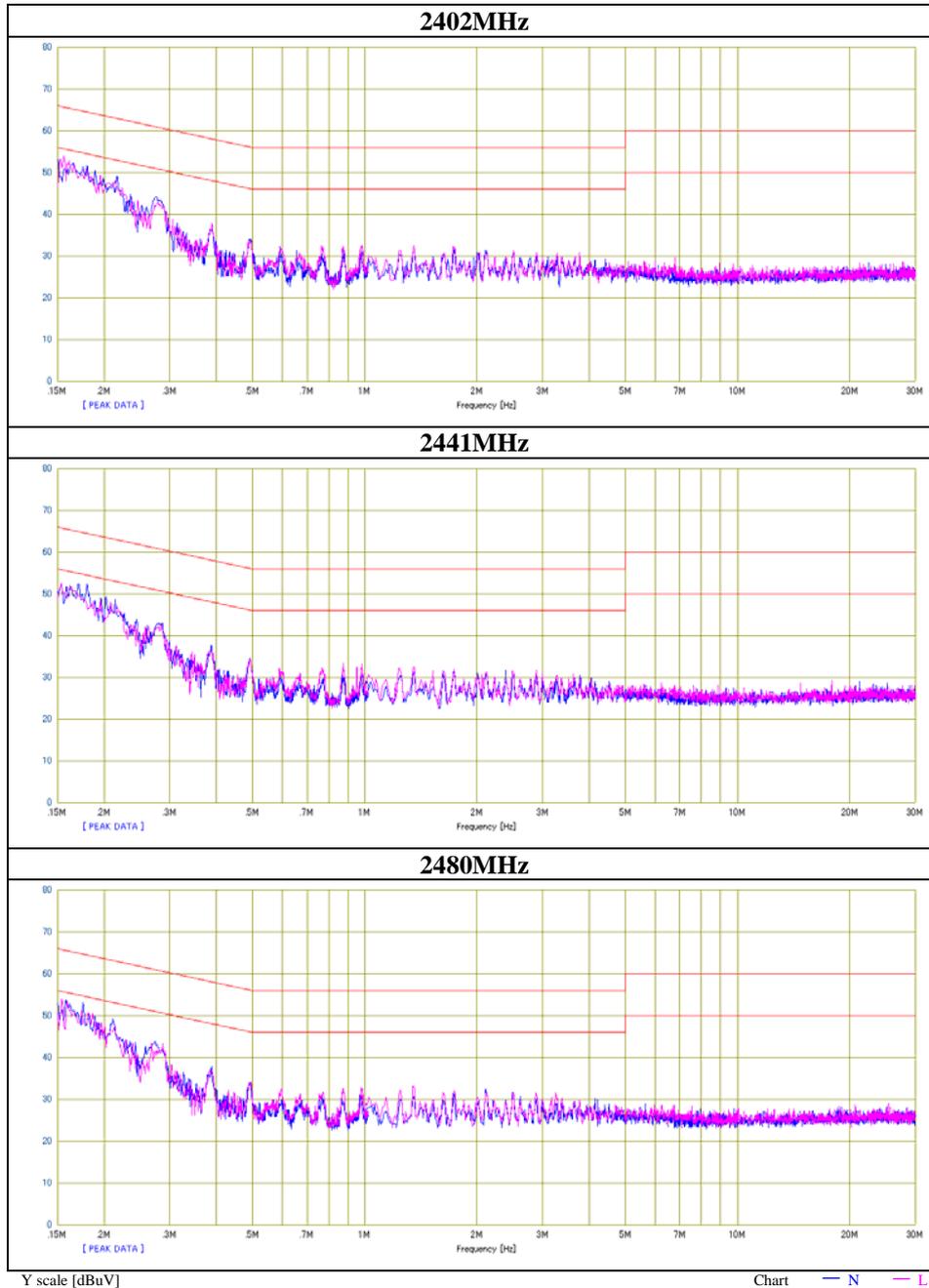


Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.16402	33.2	19.3	13.2	46.4	32.5	65.3	55.3	18.9	22.8	N	
0.21361	28.3	16.8	13.3	41.6	30.1	63.1	53.1	21.5	23.0	N	
0.27799	25.5	17.3	13.3	38.8	30.6	60.9	50.9	22.1	20.3	N	
0.38304	19.5	16.3	13.3	32.8	29.6	58.2	48.2	25.4	18.6	N	
0.48744	16.8	15.2	13.3	30.1	28.5	56.2	46.2	26.1	17.7	N	
1.35831	14.6	13.5	13.3	27.9	26.8	56.0	46.0	28.1	19.2	N	
0.16141	33.2	18.0	13.2	46.4	31.2	65.4	55.4	19.0	24.2	L	
0.21677	28.1	13.4	13.3	41.4	26.7	62.9	52.9	21.5	26.2	L	
0.27959	24.7	17.4	13.3	38.0	30.7	60.8	50.8	22.8	20.1	L	
0.38348	20.4	18.4	13.3	33.7	31.7	58.2	48.2	24.5	16.5	L	
0.48814	17.4	17.1	13.3	30.7	30.4	56.2	46.2	25.5	15.8	L	
1.35927	16.4	15.4	13.3	29.7	28.7	56.0	46.0	26.3	17.3	L	

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

## Conducted Emission

Test place	Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No.	31GE0056-HO-01
Date	02/18/2011
Temperature/ Humidity	22 deg.C./ 32%
Engineer	Takumi Shimada
Mode	Tx DH5



## Conducted Emission

### DATA OF CONDUCTED EMISSION TEST

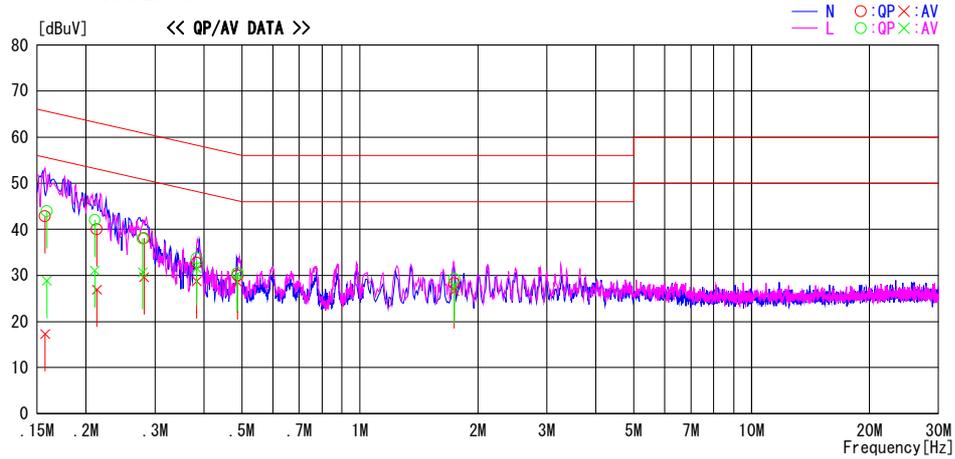
UL Japan, Inc. Head Office EMC Lab. No. 4 Semi Anechoic Chamber  
Date : 2011/02/18 16:49:56

Report No. : 31GE0056-HO-01

Temp./Humi. : 22deg. C / 32%  
Engineer : Takumi Shimada

Mode / Remarks : Tx 2441MHz 3DH5

LIMIT : FCC15.207 QP  
FCC15.207 AV

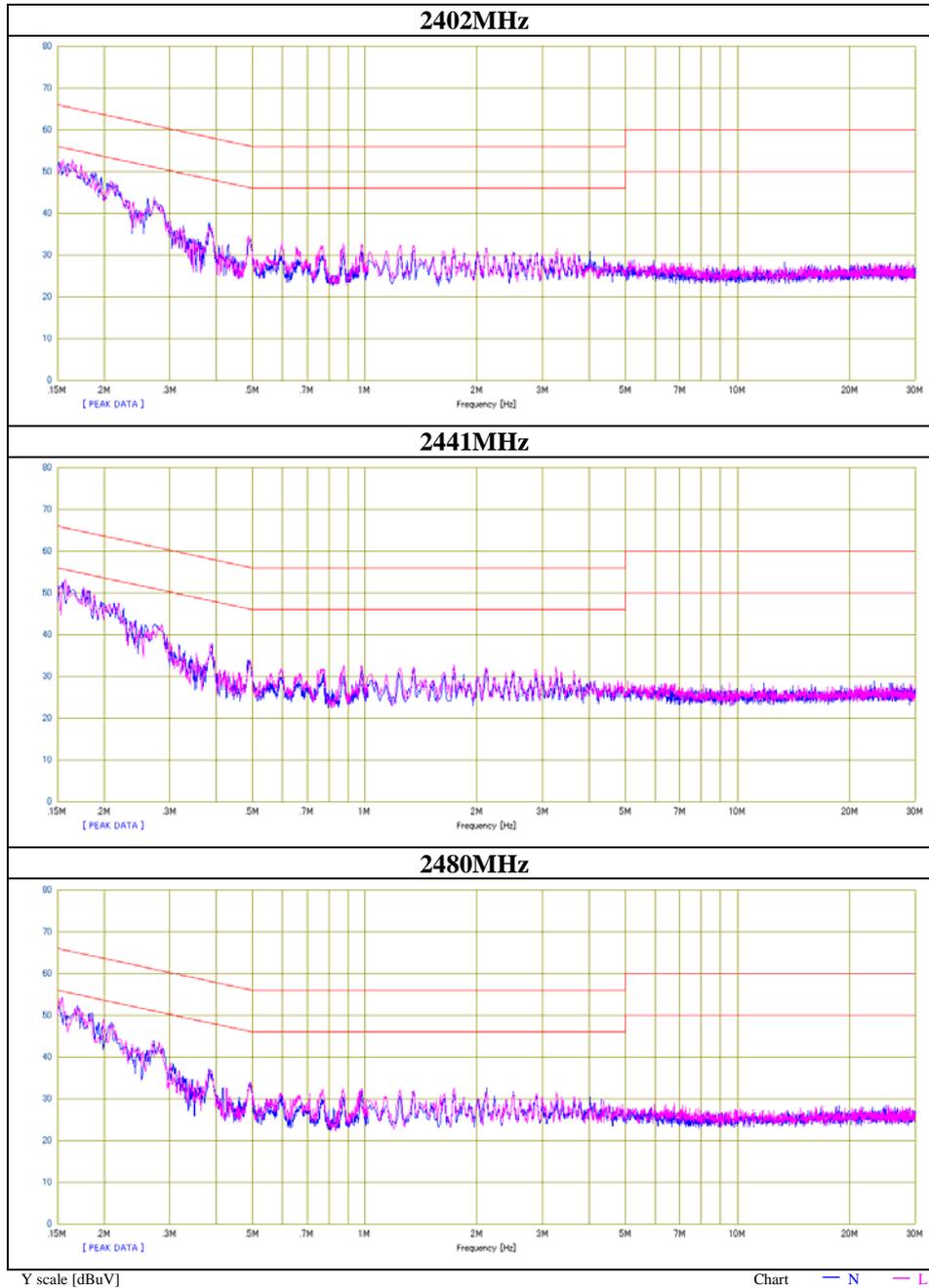


Frequency [MHz]	Reading Level		Corr. Factor	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15718	29.6	4.1	13.2	42.8	17.3	65.6	55.6	22.8	38.3	N	
0.21322	26.7	13.6	13.3	40.0	26.9	63.1	53.1	23.1	26.2	N	
0.28102	24.8	16.3	13.3	38.1	29.6	60.8	50.8	22.7	21.2	N	
0.38308	19.4	15.4	13.3	32.7	28.7	58.2	48.2	25.5	19.5	N	
0.48756	16.7	15.2	13.3	30.0	28.5	56.2	46.2	26.2	17.7	N	
1.74102	15.0	13.3	13.3	28.3	26.6	56.0	46.0	27.7	19.4	N	
0.15867	30.8	15.6	13.2	44.0	28.8	65.5	55.5	21.5	26.7	L	
0.21062	28.7	17.8	13.3	42.0	31.1	63.2	53.2	21.2	22.1	L	
0.27889	24.7	17.4	13.3	38.0	30.7	60.8	50.8	22.8	20.1	L	
0.38335	20.4	18.3	13.3	33.7	31.6	58.2	48.2	24.5	16.6	L	
0.48731	17.2	17.0	13.3	30.5	30.3	56.2	46.2	25.7	15.9	L	
1.74092	16.0	14.4	13.3	29.3	27.7	56.0	46.0	26.7	18.3	L	

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

## Conducted Emission

Test place	Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No.	31GE0056-HO-01
Date	02/18/2011
Temperature/ Humidity	22 deg.C./ 32%
Engineer	Takumi Shimada
Mode	Tx 3DH5



**Conducted Emission**  
**(Reference data)**

**DATA OF CONDUCTED EMISSION TEST**

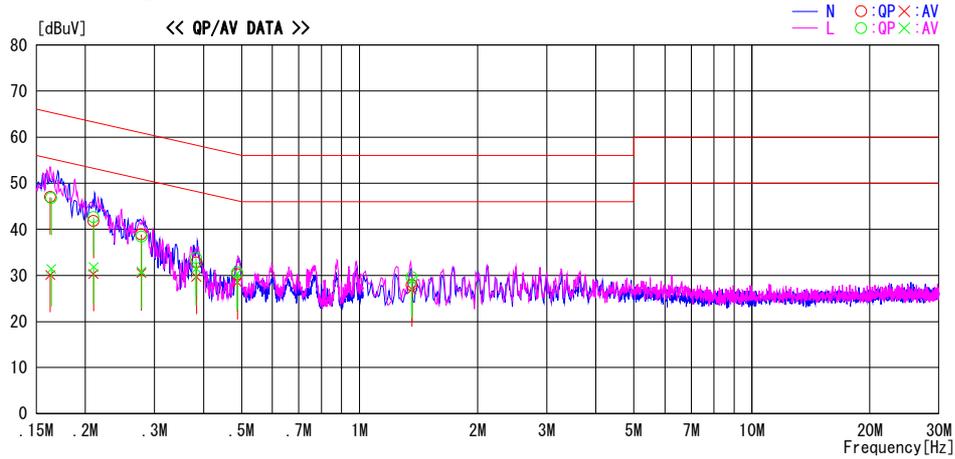
UL Japan, Inc. Head Office EMC Lab. No. 4 Semi Anechoic Chamber  
Date : 2011/02/18 16:57:24

Report No. : 31GE0056-HO-01

Temp./Humi. : 22deg. C / 32%  
Engineer : Takumi Shimada

Mode / Remarks : Rx 2441MHz

LIMIT : FCC15.207 QP  
FCC15.207 AV



Frequency [MHz]	Reading		Level [dBuV]	Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]			QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.16278	33.8	16.9	13.2	47.0	30.1	65.3	55.3	18.3	25.2	N		
0.20954	28.5	17.0	13.3	41.8	30.3	63.2	53.2	21.4	22.9	N		
0.27775	25.6	17.2	13.3	38.9	30.5	60.9	50.9	22.0	20.4	N		
0.38360	19.5	16.4	13.3	32.8	29.7	58.2	48.2	25.4	18.5	N		
0.48802	16.9	15.2	13.3	30.2	28.5	56.2	46.2	26.0	17.7	N		
1.35869	14.6	13.7	13.3	27.9	27.0	56.0	46.0	28.1	19.0	N		
0.16366	33.6	18.2	13.2	46.8	31.4	65.3	55.3	18.5	23.9	L		
0.20988	29.3	18.5	13.3	42.6	31.8	63.2	53.2	20.6	21.4	L		
0.27815	25.1	17.5	13.3	38.4	30.8	60.9	50.9	22.5	20.1	L		
0.38347	20.5	18.2	13.3	33.8	31.5	58.2	48.2	24.4	16.7	L		
0.48821	17.3	17.1	13.3	30.6	30.4	56.2	46.2	25.6	15.8	L		
1.35873	16.3	15.5	13.3	29.6	28.8	56.0	46.0	26.4	17.2	L		

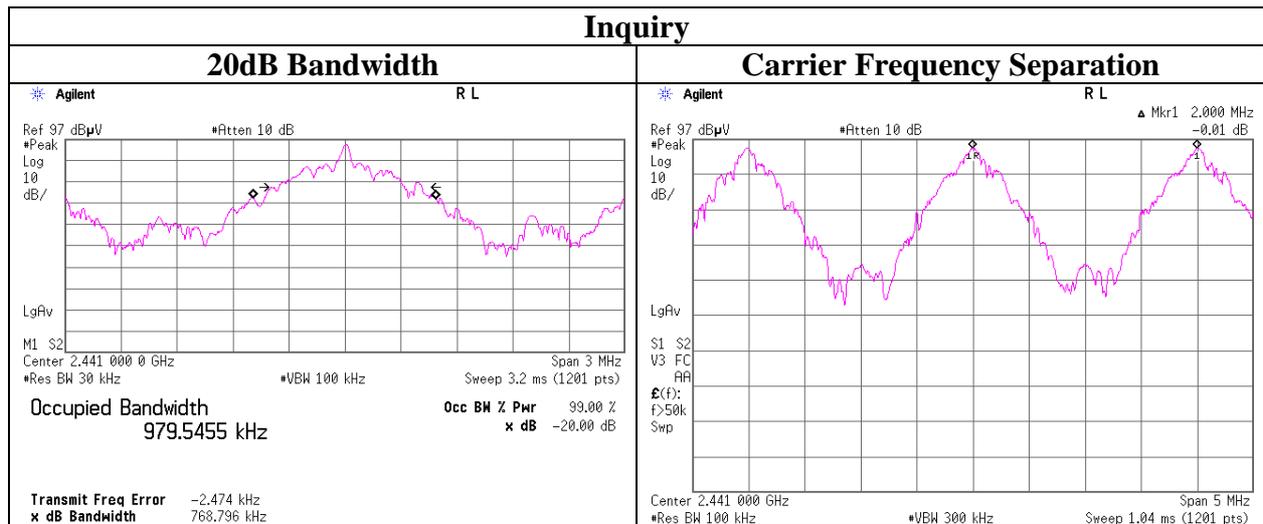
CHART: WITH FACTOR, Peak hold data. CALCULATION: RESULT=READING+C.F (LISN LOSS+CABLE LOSS+ATTEN. LOSS)  
Except for the above table : adequate margin data below the limits.

## 20dB Bandwidth and Carrier Frequency Separation

Test place	Head Office EMC Lab. No.6 Shielded Room
Report No.	31GE0056-HO-01
Date	02/19/2011
Temperature/ Humidity	24 deg.C./ 47%
Engineer	Takumi Shimada
Mode	Tx (Hopping on) DH5/3DH5/Inquiry

Mode	Freq. [MHz]	20dB Bandwidth [MHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	0.924	1.000	$\geq 0.616$
DH5	2441.0	0.930	1.000	$\geq 0.620$
DH5	2480.0	0.921	1.000	$\geq 0.614$
3DH5	2402.0	1.298	1.000	$\geq 0.865$
3DH5	2441.0	1.293	1.000	$\geq 0.862$
3DH5	2480.0	1.299	1.000	$\geq 0.866$
Inquiry	2441.0	0.769	2.000	$\geq 0.513$

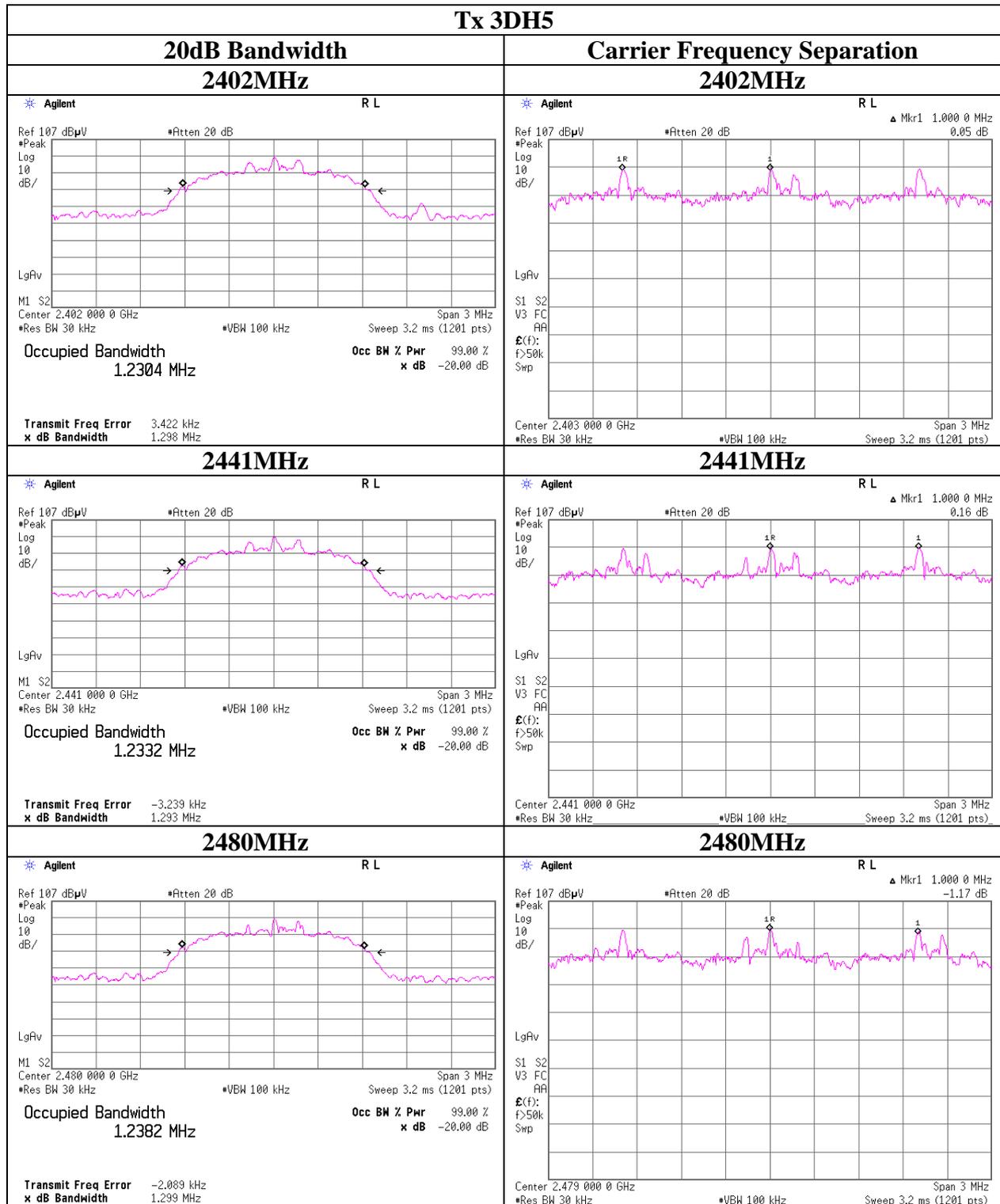
Limit: Two-thirds of 20dB Bandwidth or 25kHz (whichever is greater).  
No limit applies to 20dB Bandwidth.



**20dB Bandwidth and Carrier Frequency Separation**

Tx DH5	
20dB Bandwidth	Carrier Frequency Separation
<b>2402MHz</b>	<b>2402MHz</b>
<p>Agilent R L  Ref 107 dBµV #Atten 20 dB  #Peak Log 10 dB/  LgAv  M1 S2  Center 2.402 000 0 GHz Span 3 MHz  #Res BW 30 kHz #VBW 100 kHz Sweep 3.2 ms (1201 pts)  Occupied Bandwidth 864.8151 kHz  Occ BN % PWR 99.00 %  x dB -20.00 dB  Transmit Freq Error -718.086 Hz  x dB Bandwidth 924.231 kHz</p>	<p>Agilent R L  Ref 107 dBµV #Atten 20 dB  #Peak Log 10 dB/  LgAv  Mkr1 1.000 0 MHz  -1.51 dB  S1 S2  V3 FC  FA  E(f): &gt;50k  Swp  Center 2.403 000 0 GHz Span 3 MHz  #Res BW 30 kHz #VBW 100 kHz Sweep 3.2 ms (1201 pts)</p>
<b>2441MHz</b>	<b>2441MHz</b>
<p>Agilent R L  Ref 107 dBµV #Atten 20 dB  #Peak Log 10 dB/  LgAv  M1 S2  Center 2.441 000 0 GHz Span 3 MHz  #Res BW 30 kHz #VBW 100 kHz Sweep 3.2 ms (1201 pts)  Occupied Bandwidth 860.2228 kHz  Occ BN % PWR 99.00 %  x dB -20.00 dB  Transmit Freq Error 4.453 kHz  x dB Bandwidth 930.476 kHz</p>	<p>Agilent R L  Ref 107 dBµV #Atten 20 dB  #Peak Log 10 dB/  LgAv  Mkr1 1.000 0 MHz  0.06 dB  S1 S2  V3 FC  FA  E(f): &gt;50k  Swp  Center 2.441 000 0 GHz Span 3 MHz  #Res BW 30 kHz #VBW 100 kHz Sweep 3.2 ms (1201 pts)</p>
<b>2480MHz</b>	<b>2480MHz</b>
<p>Agilent R L  Ref 107 dBµV #Atten 20 dB  #Peak Log 10 dB/  LgAv  M1 S2  Center 2.480 000 0 GHz Span 3 MHz  #Res BW 30 kHz #VBW 100 kHz Sweep 3.2 ms (1201 pts)  Occupied Bandwidth 856.5086 kHz  Occ BN % PWR 99.00 %  x dB -20.00 dB  Transmit Freq Error 3.752 kHz  x dB Bandwidth 921.477 kHz</p>	<p>Agilent R L  Ref 107 dBµV #Atten 20 dB  #Peak Log 10 dB/  LgAv  Mkr1 1.000 0 MHz  3.65 dB  S1 S2  V3 FC  FA  E(f): &gt;50k  Swp  Center 2.479 000 0 GHz Span 3 MHz  #Res BW 30 kHz #VBW 100 kHz Sweep 3.2 ms (1201 pts)</p>

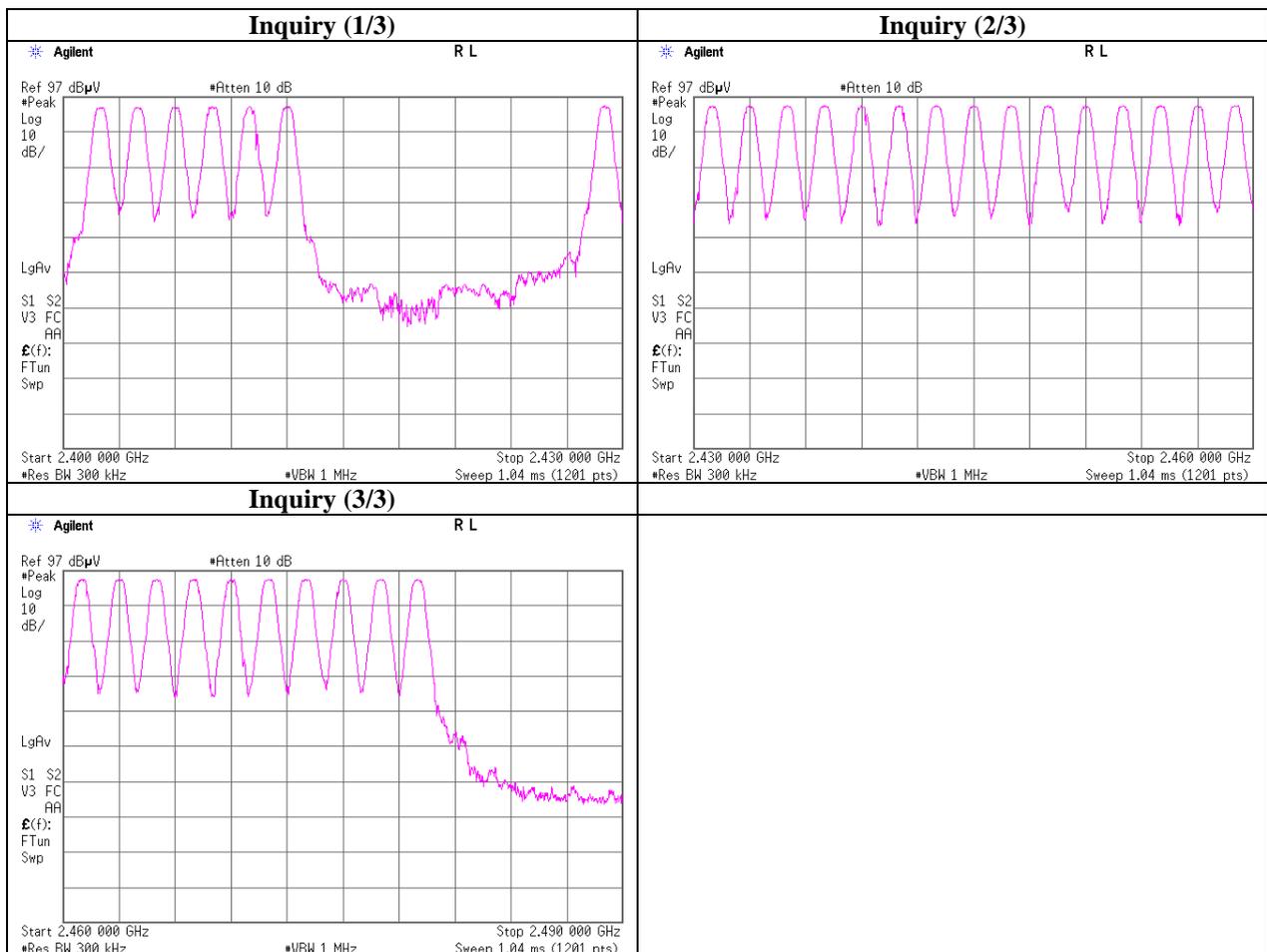
**20dB Bandwidth and Carrier Frequency Separation**



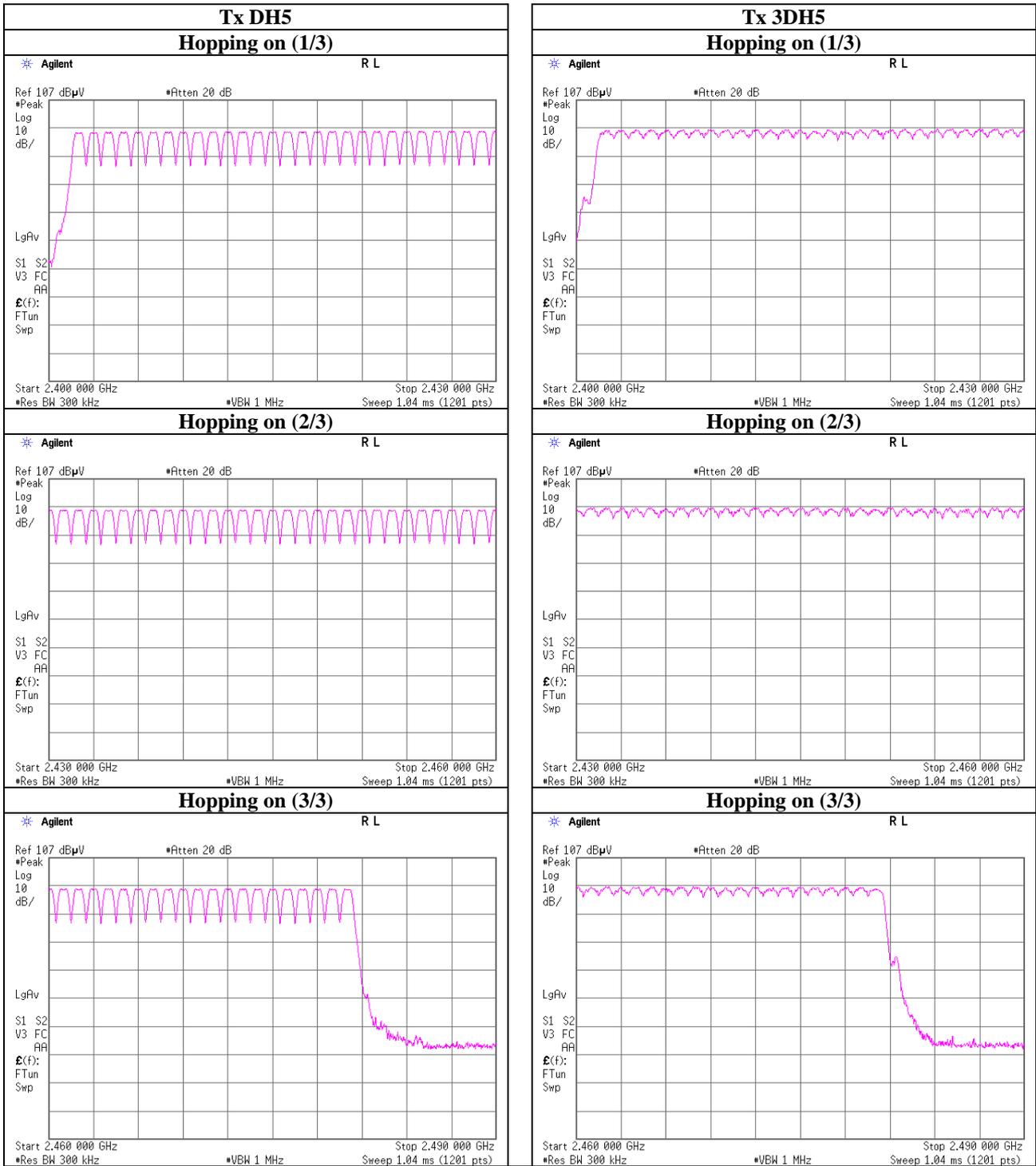
## Number of Hopping Frequency

Test place	Head Office EMC Lab. No.6 Shielded Room
Report No.	31GE0056-HO-01
Date	02/19/2011
Temperature/ Humidity	24 deg.C./ 47%
Engineer	Takumi Shimada
Mode	Tx (Hopping on) DH5/3DH5/Inquiry

Mode	Number of channel [times]	Limit [times]
DH5	79	>= 15
3DH5	79	>= 15
Inquiry	32	>= 15



## Number of Hopping Frequency



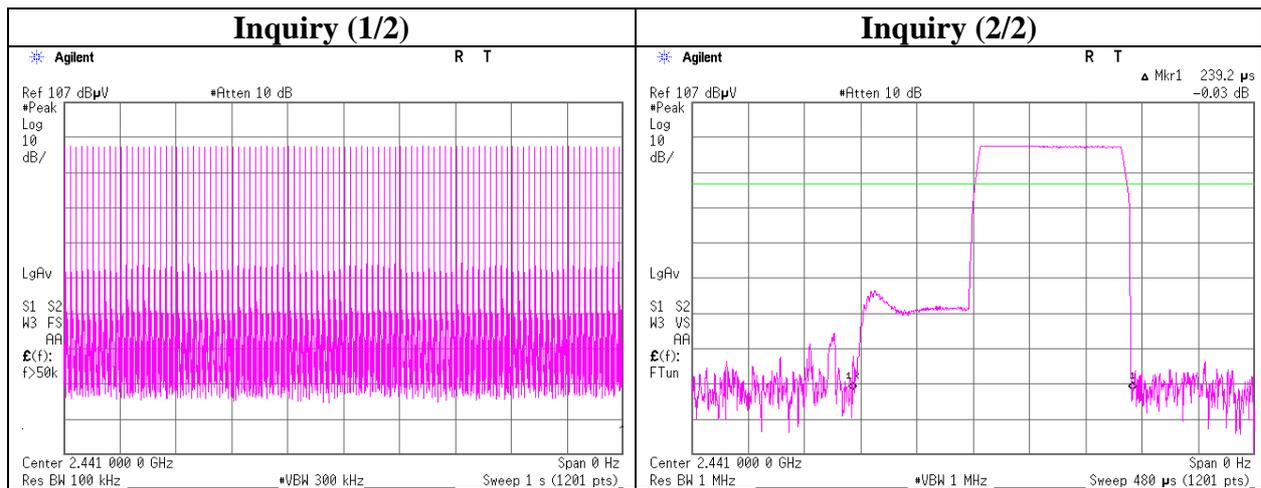
## Dwell time

Test place	Head Office EMC Lab. No.6 Shielded Room
Report No.	31GE0056-HO-01
Date	02/19/2011
Temperature/ Humidity	24 deg.C./ 47%
Engineer	Takumi Shimada
Mode	Tx (Hopping on) DH5/3DH5/Inquiry

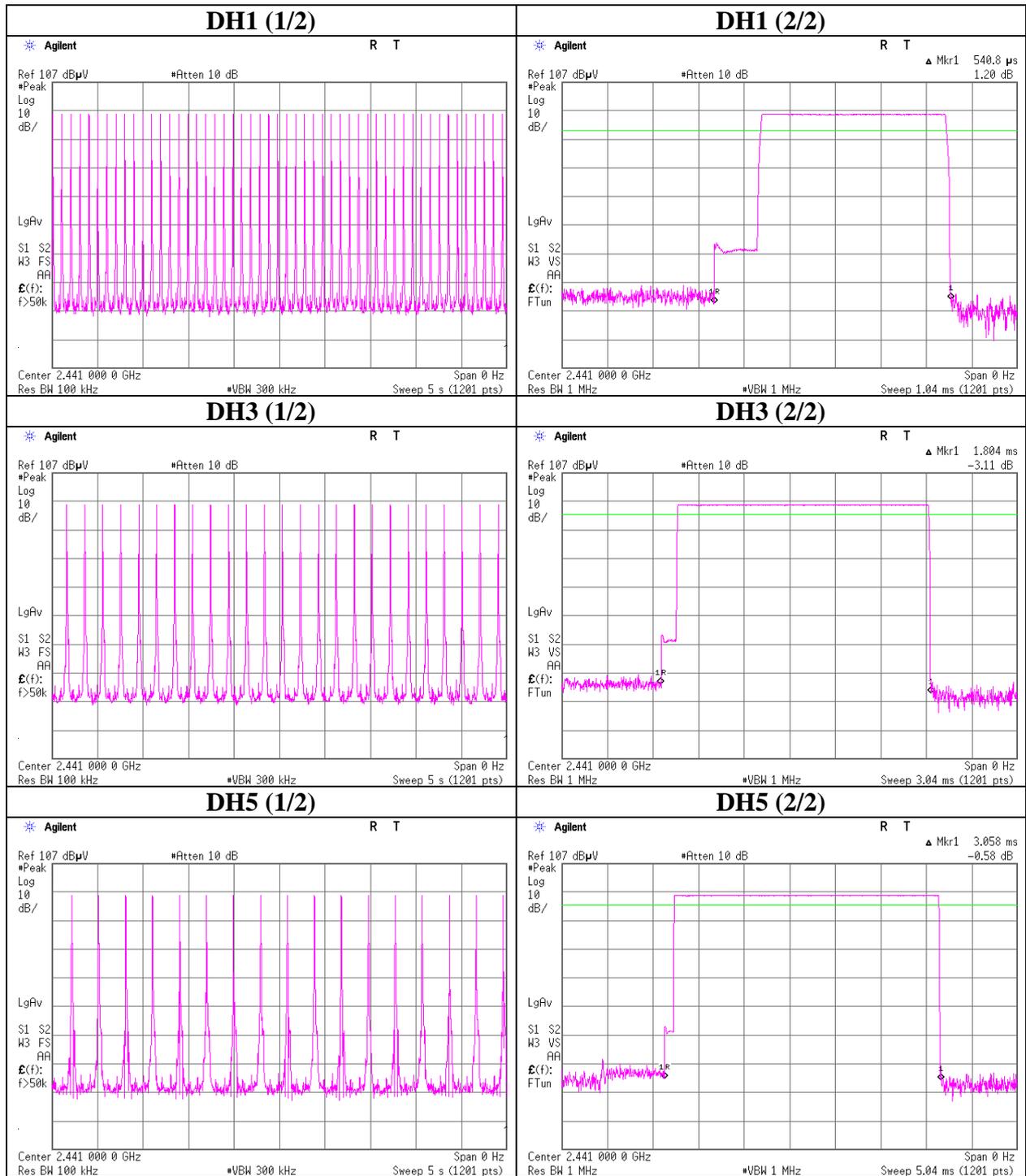
Mode	Number of transmission in a 31.6(79 Hopping x 0.4) / 12.8(32 Hopping x 0.4)second period		Length of transmission time [msec]	Result [msec]	Limit [msec]		
DH1	51.0 times /	5 sec. x	31.6 sec. =	323 times	0.541	175	400
DH3	25.0 times /	5 sec. x	31.6 sec. =	158 times	1.804	285	400
DH5	17.0 times /	5 sec. x	31.6 sec. =	108 times	3.058	330	400
3DH1	51.0 times /	5 sec. x	31.6 sec. =	323 times	0.569	184	400
3DH3	25.0 times /	5 sec. x	31.6 sec. =	158 times	1.832	289	400
3DH5	17.0 times /	5 sec. x	31.6 sec. =	108 times	3.079	333	400
Inquiry	100.0 times /	1 sec. x	12.8 sec. =	1280 times	0.239	306	400

Sample Calculation

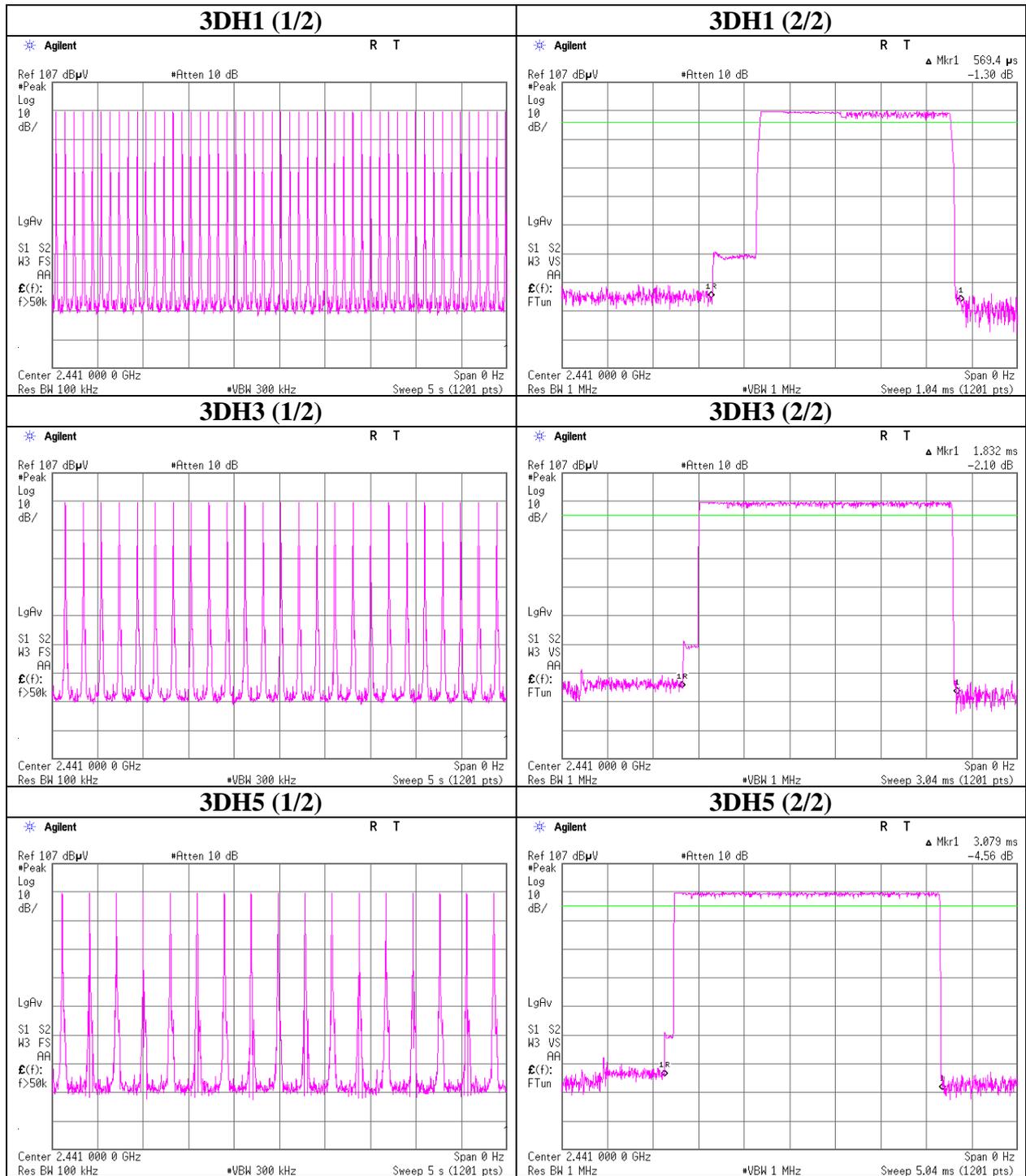
Result = Number of transmission x Length of transmission time



**Dwell time**



**Dwell time**



## Maximum Peak Output Power

Test place                      Head Office EMC Lab. No.6 Shielded Room  
Report No.                      31GE0056-HO-01  
Date                              02/19/2011  
Temperature/ Humidity        24 deg.C./ 47%  
Engineer                        Takumi Shimada  
Mode                              Tx (Hopping off) DH5/3DH5/Inquiry

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
					[dBm]	[mW]	[dBm]	[mW]	
DH5	2402.0	-11.51	0.50	9.97	-1.04	0.79	20.97	125	22.01
DH5	2441.0	-11.10	0.50	9.97	-0.63	0.86	20.97	125	21.60
DH5	2480.0	-11.17	0.50	9.97	-0.70	0.85	20.97	125	21.67
2DH5	2402.0	-9.76	0.50	9.97	0.71	1.18	20.97	125	20.26
2DH5	2441.0	-9.39	0.50	9.97	1.08	1.28	20.97	125	19.89
2DH5	2480.0	-9.57	0.50	9.97	0.90	1.23	20.97	125	20.07
3DH5	2402.0	-9.72	0.15	9.98	0.41	1.10	20.97	125	20.56
3DH5	2441.0	-9.33	0.15	9.98	0.80	1.20	20.97	125	20.17
3DH5	2480.0	-9.51	0.15	9.98	0.62	1.15	20.97	125	20.35
Inquiry	2441.0	-12.51	0.15	9.98	-2.38	0.58	20.97	125	23.35

Sample Calculation:

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

Test was not performed at AFH mode, because the decrease of number of channel (min: 20ch) at AFH mode does not influence on the output power and bandwidth of the EUT.

As this device had AFH mode and frequency separation could not meet the requirement of over 20dB BW without 2/3 relaxation, 125mW power limit was applied to it.

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**UL Japan, Inc.**

**Head Office EMC Lab.**

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Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

















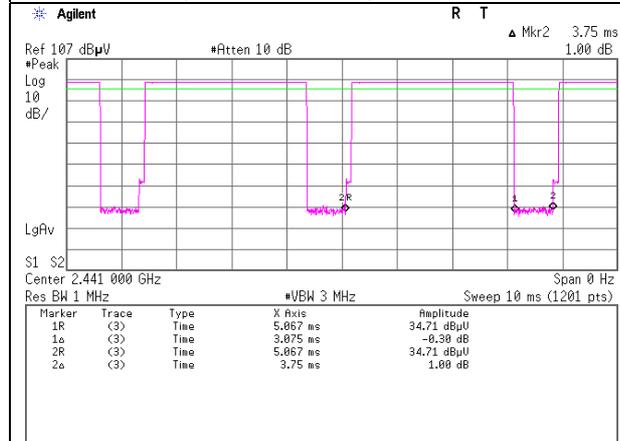




## VBW (AV) Calculation

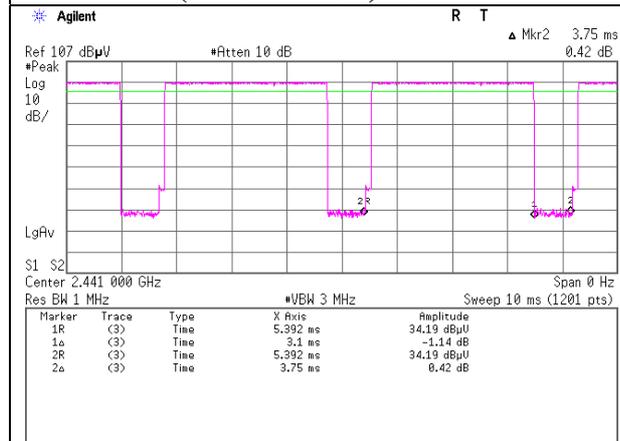
### Tx DH5

**VBW:  $1/x = 266\text{Hz} < 270\text{Hz}$**   
**x: (Tx on+Tx off) = 3.75ms**



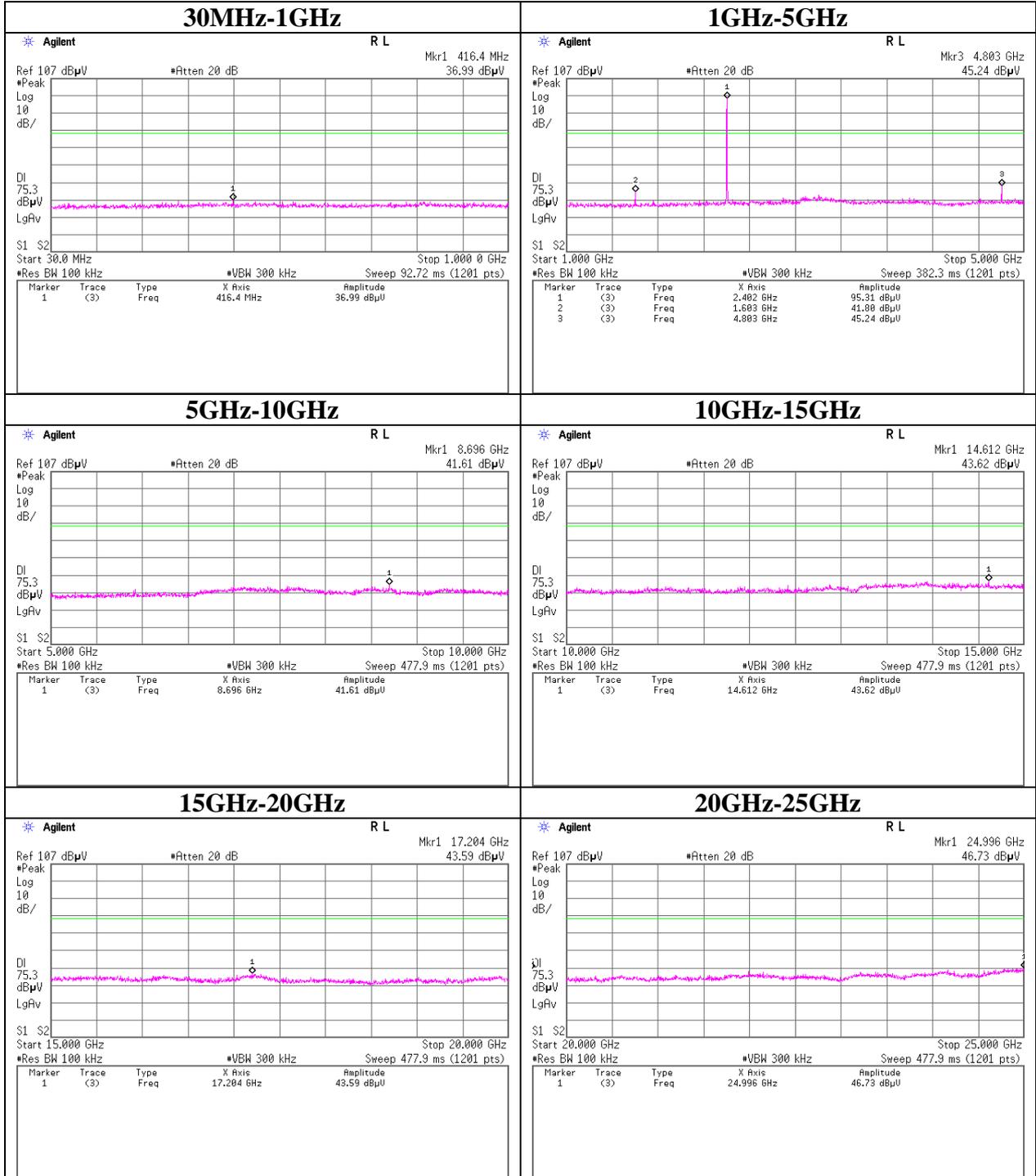
### Tx 3DH5

**VBW:  $1/x = 266\text{Hz} < 270\text{Hz}$**   
**x: (Tx on+Tx off) = 3.75ms**



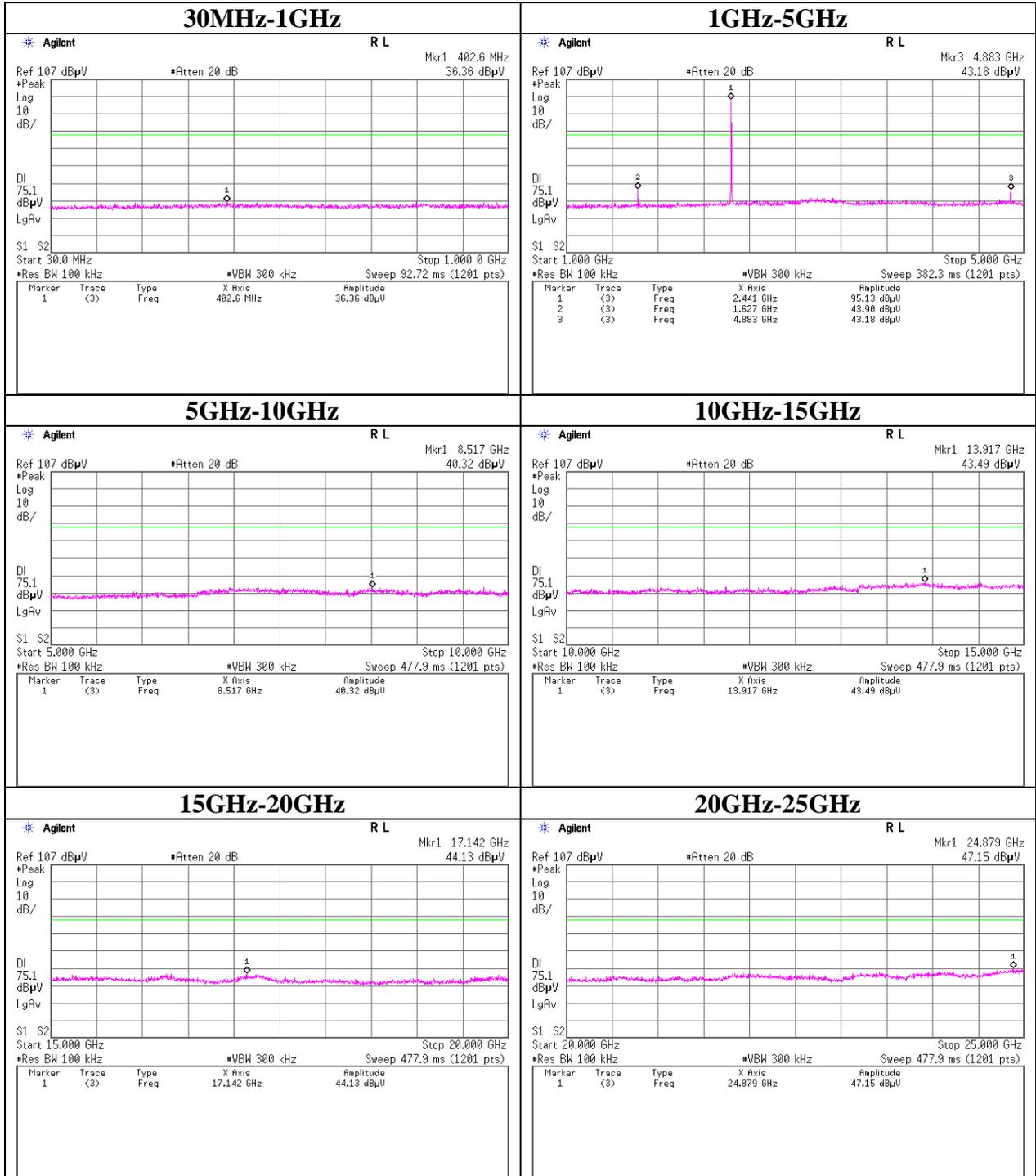
**Conducted Spurious Emission**

**Tx DH5 2402MHz**



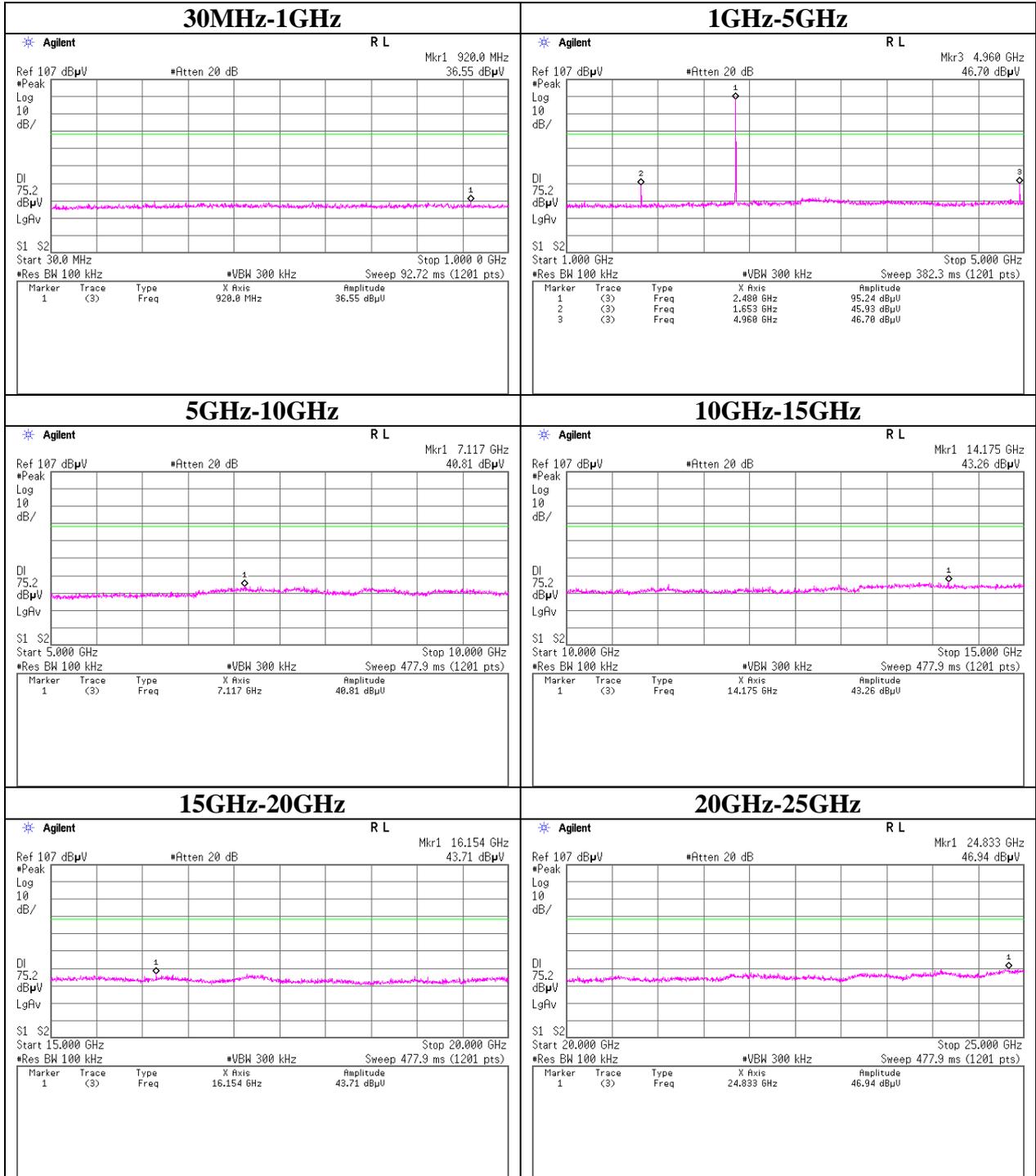
**Conducted Spurious Emission**

**Tx DH5 2441MHz**



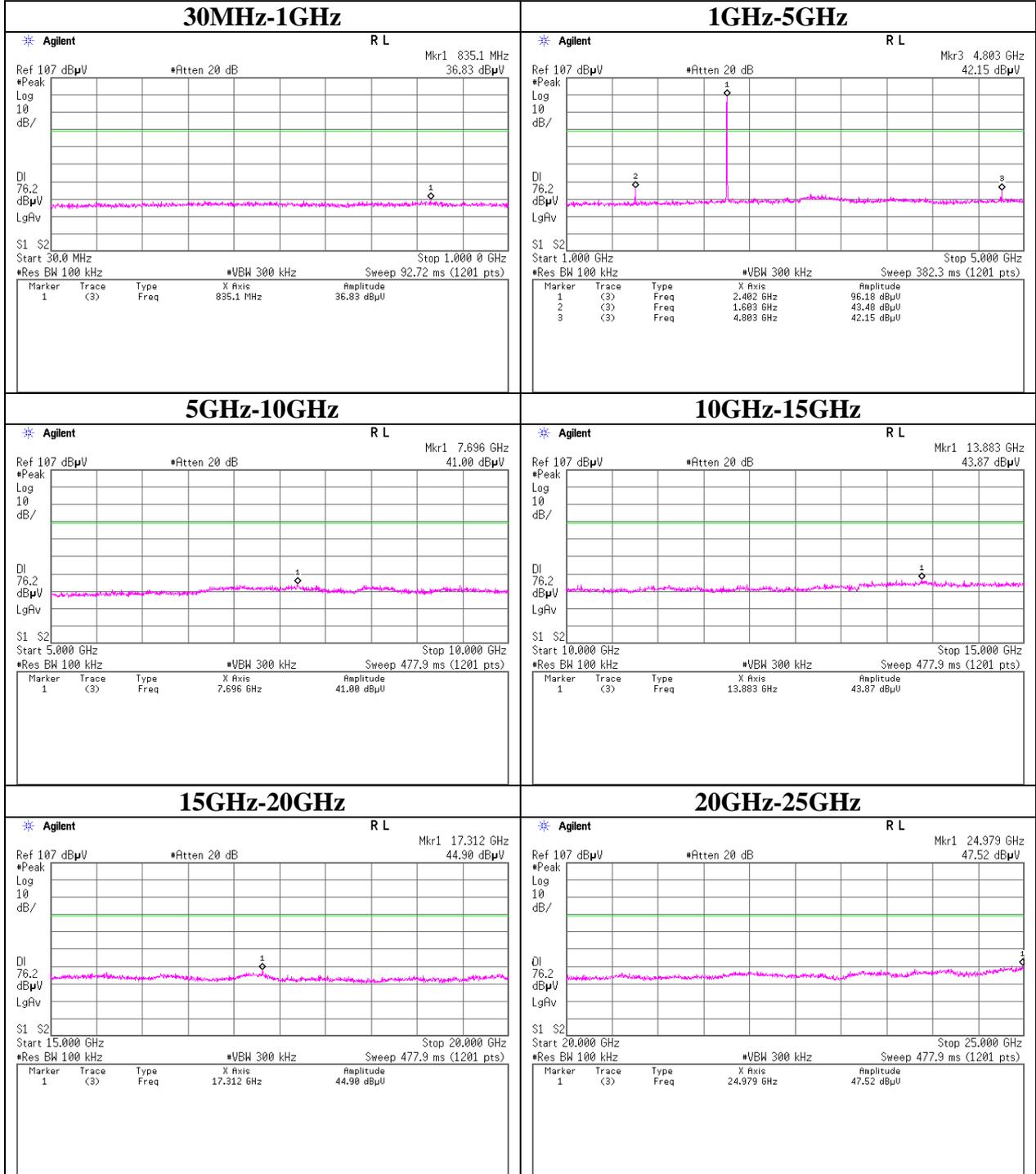
**Conducted Spurious Emission**

**Tx DH5 2480MHz**



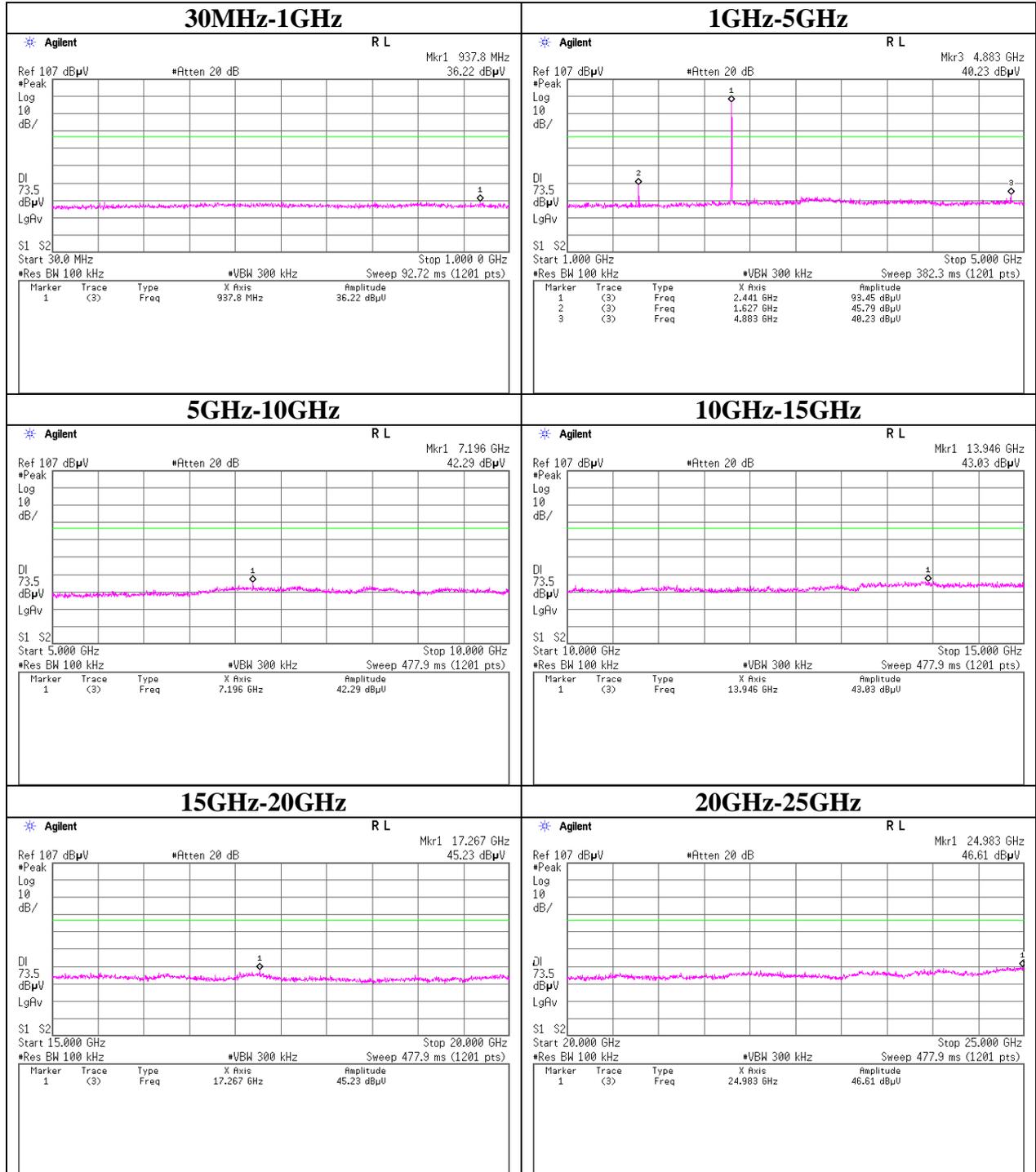
**Conducted Spurious Emission**

**Tx 3DH5 2402MHz**



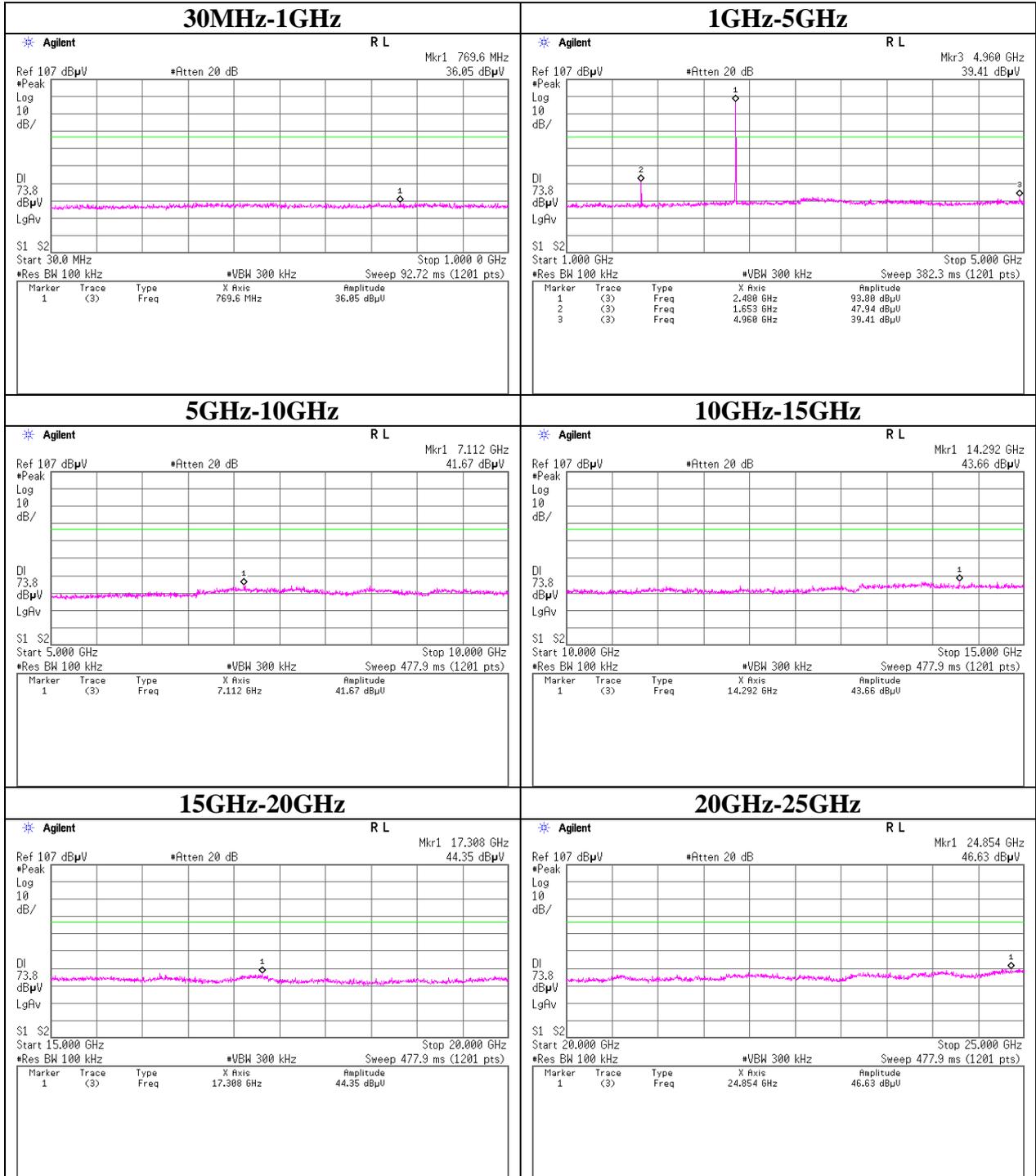
## Conducted Spurious Emission

### Tx 3DH5 2441MHz



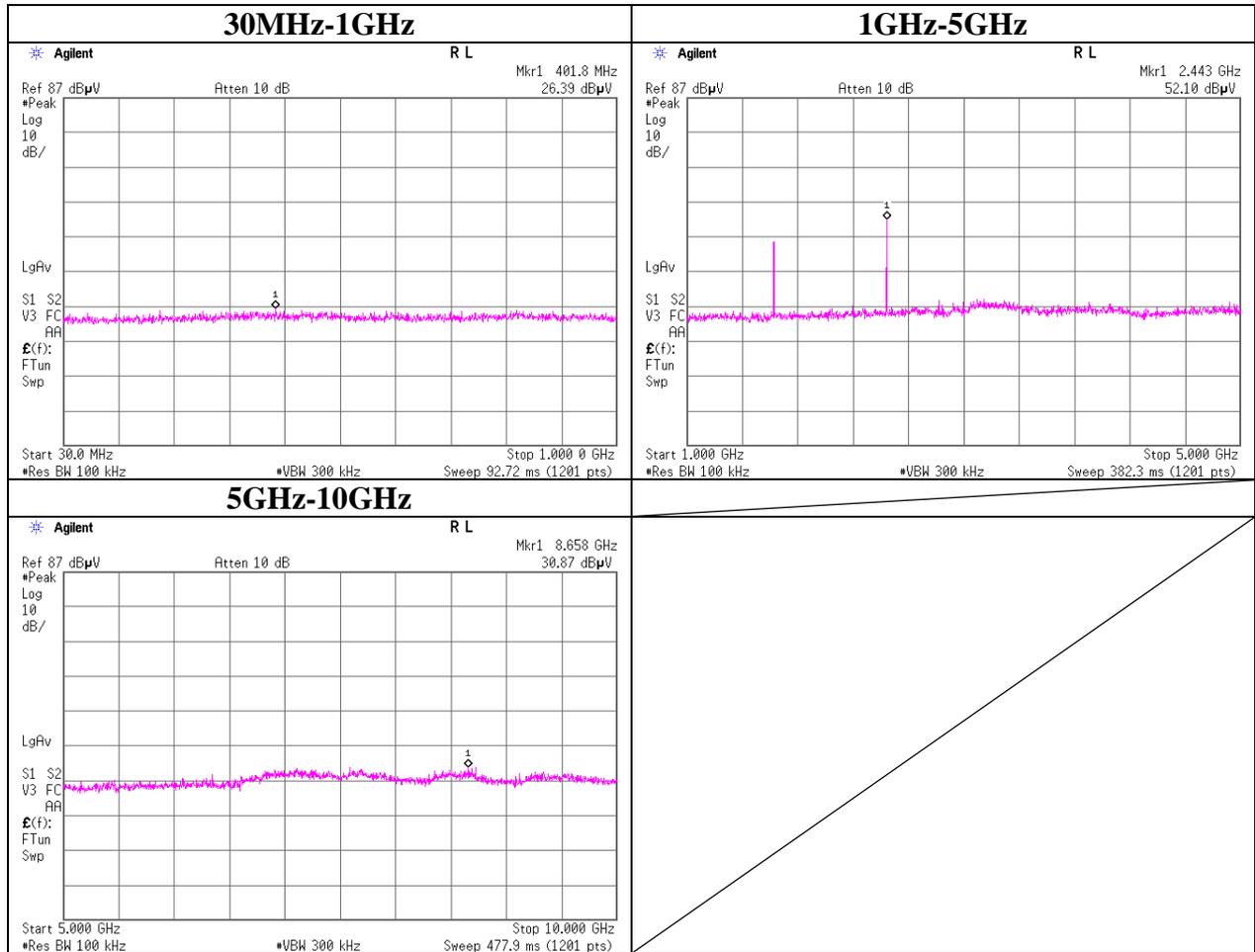
**Conducted Spurious Emission**

**Tx 3DH5 2480MHz**



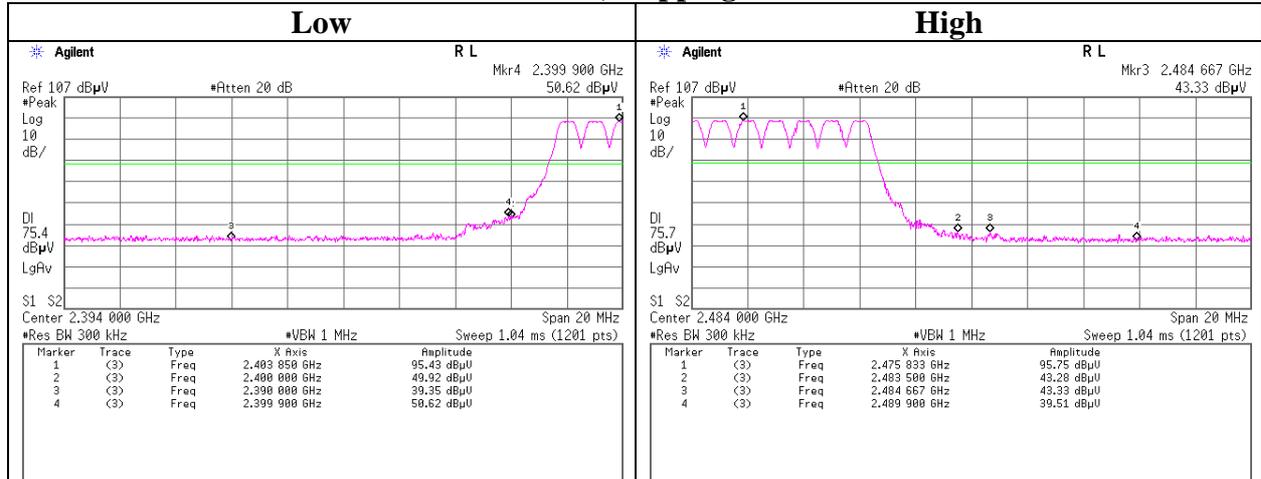
**Conducted Spurious Emission**  
**(Reference data)**

**Rx 2441MHz**

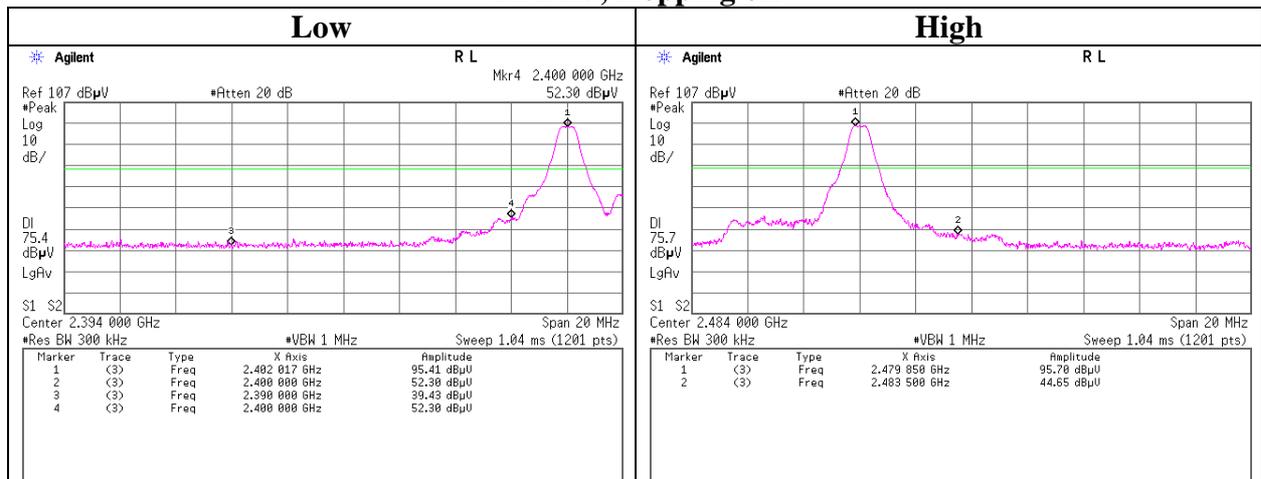


**Conducted Emission Band Edge compliance**

**Tx DH5, Hopping on**

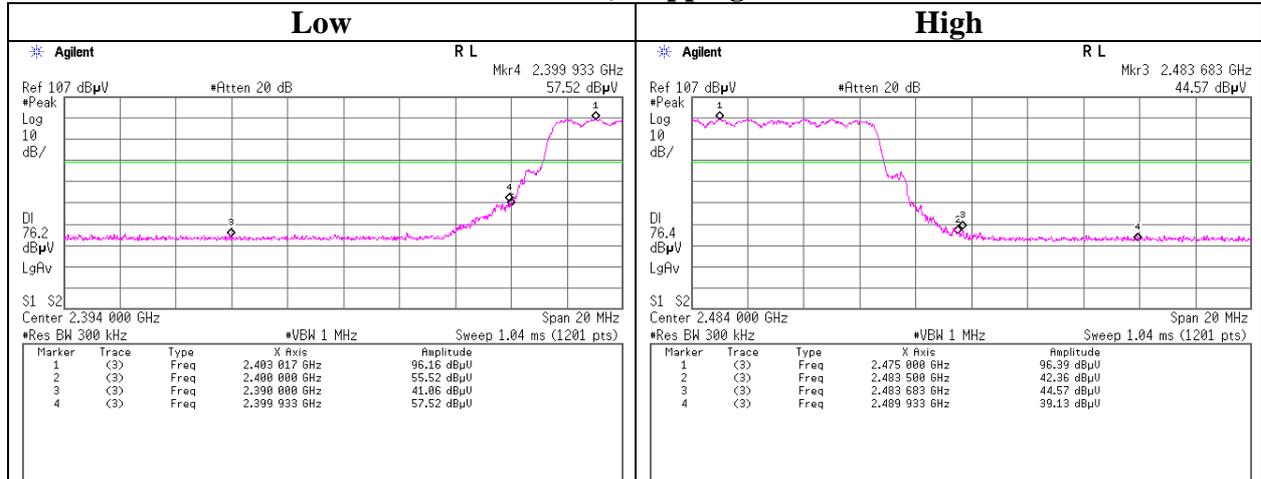


**Tx DH5, Hopping off**

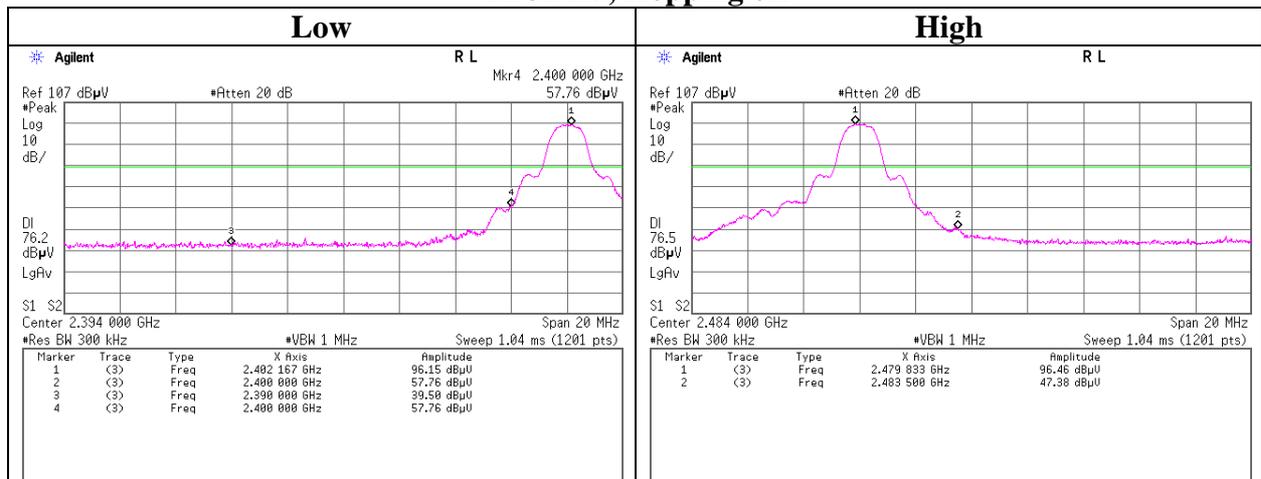


**Conducted Emission Band Edge compliance**

**Tx 3DH5, Hopping on**



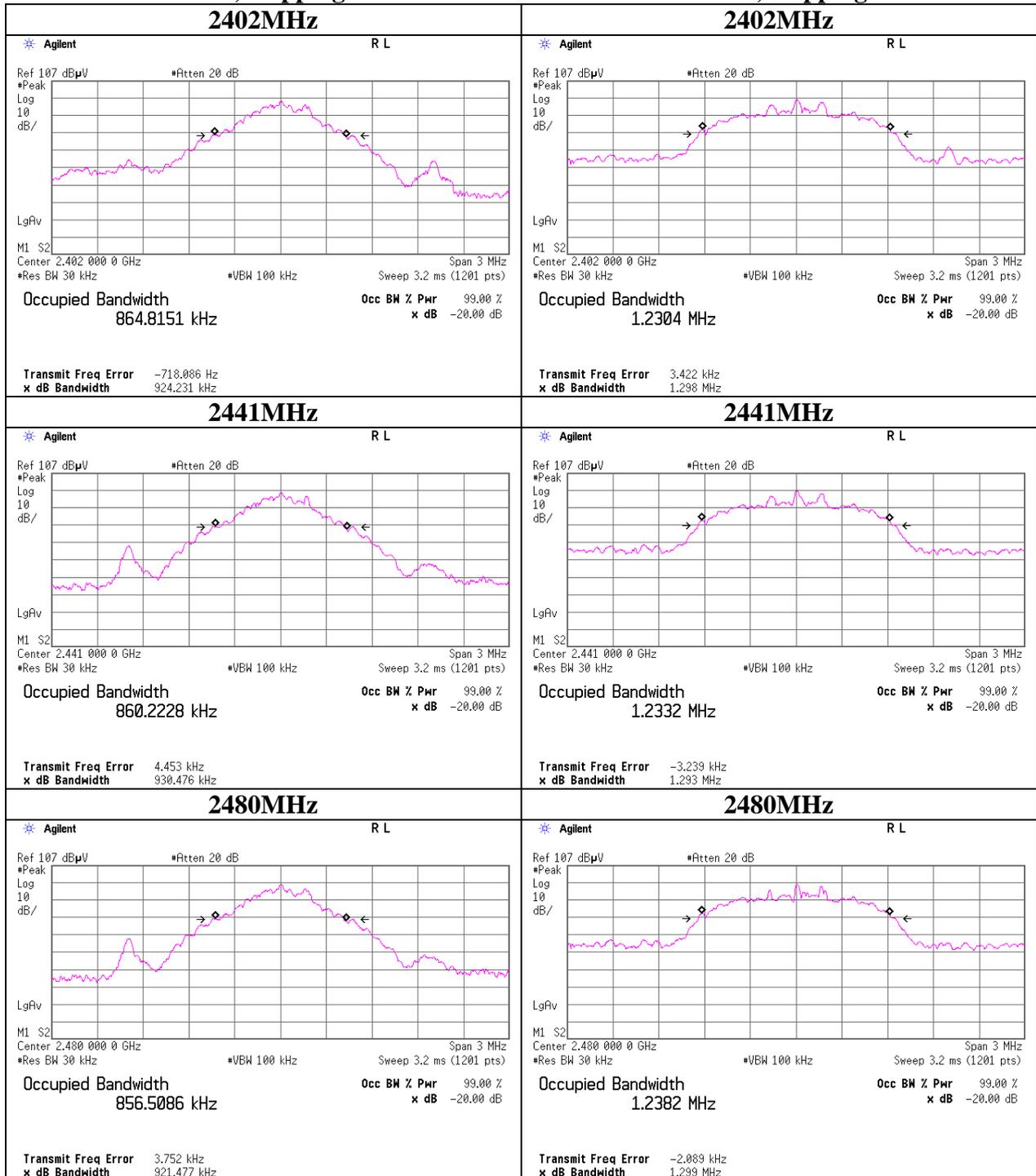
**Tx 3DH5, Hopping off**



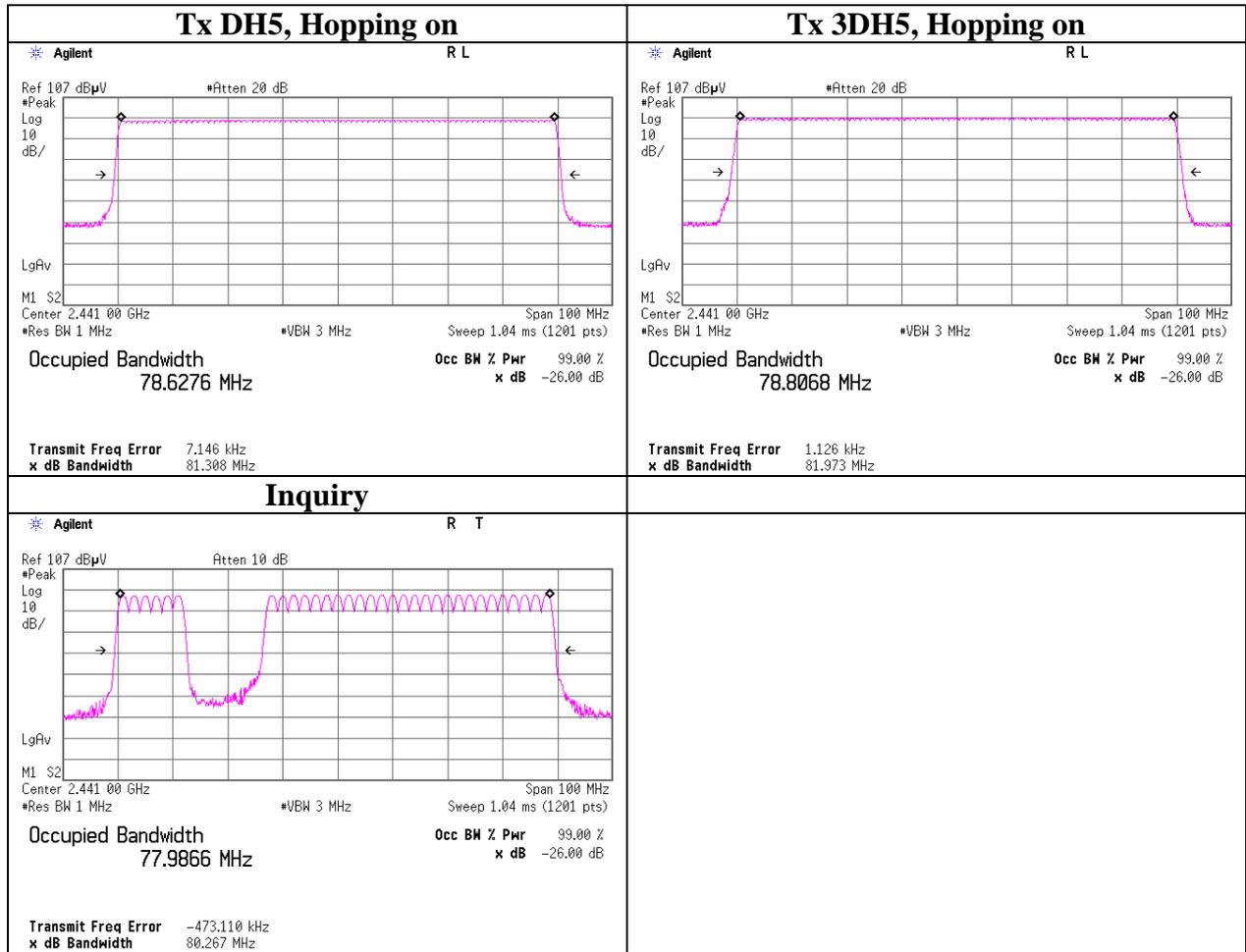
**99% Occupied Bandwidth**

**Tx DH5, Hopping off**

**Tx 3DH5, Hopping off**



### 99% Occupied Bandwidth



### **APPENDIX 3: Test instruments**

#### **EMI test equipment**

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE/CE	2010/02/02 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	-	RE/CE	2010/02/09 * 12
MJM-07	Measure	PROMART	SEN1955	-	RE/CE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MSA-05	Spectrum Analyzer	Advantest	R3273	160400285	RE/CE	2010/11/18 * 12
MTR-07	Test Receiver	Rohde & Schwarz	ESCI	100635	RE/CE	2010/10/27 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2010/10/11 * 12
MLA-08	Logperiodic Antenna	Schwarzbeck	UKLP9140-A	N/A	RE	2010/10/11 * 12
MCC-50	Coaxial cable	UL Japan	-	-	RE	2010/03/18 * 12
MAT-51	Attenuator(6dB)	Weinschel	2	AS3557	RE	2011/01/14 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2010/03/05 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2010/09/09 * 12
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE	2010/02/03 * 12
MHA-21	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	RE	2010/08/08 * 12
MCC-57	Microwave Cable	Suhner	SUCOFLEX104	267195/4(0.6m) / 292411(5m)	RE	2010/11/26 * 12
MPA-12	MicroWave System Amplifier	Agilent	83017A	MY39500780	RE	2010/03/16 * 12
MHA-17	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170307	RE	2010/06/29 * 12
MLS-06	LISN(AMN)	Schwarzbeck	NSLK8127	8127363	CE(EUT)	2010/02/04 * 12
MAT-67	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2010/02/04 * 12
MCC-113	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/SFM141(5m)/421-010(1m)/sucoform141-PE(1m)/RFM-E121(Switcher)	-/04178	CE	2010/07/21 * 12
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	AT	2010/11/30 * 12
MAT-24	Attenuator(10dB)(above 1GHz)	Agilent	8493C	71389	AT	2010/06/14 * 12
MPM-09	Power Meter	Anritsu	ML2495A	6K00003348	AT	2010/09/10 * 12
MPSE-12	Power sensor	Anritsu	MA2411B	011598	AT	2010/09/10 * 12
MOS-14	Thermo-Hygrometer	Custom	CTH-201	-	AT	2010/05/19 * 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**

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