



RADIO TEST REPORT

Test Report No. : 32LE0299-HO-01-A

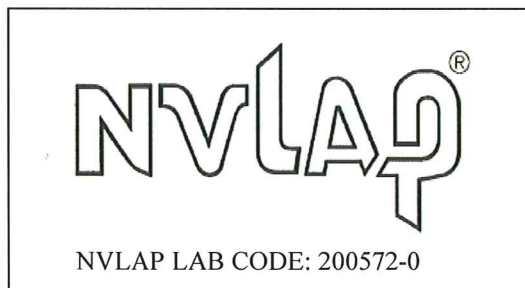
Applicant : Onkyo Corporation
Type of Equipment : BT Module
Model No. : HRM1014
FCC ID : ATMLS3100
Test regulation : FCC Part 15 Subpart C: 2012
Test Result : Complied

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Date of test: August 27 to September 4, 2012

Representative test engineer: T. Shimada
Takumi Shimada
Engineer of WiSE Japan,
UL Verification Service

Approved by: M. Nishiyama
Masanori Nishiyama
Leader of WiSE Japan,
UL Verification Service



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SECTION 1: Customer information

Company Name : Onkyo Corporation
Address : 2-1 Nisshin-cho, Neyagawa-shi, OSAKA, 572-8540 JAPAN
Telephone Number : +81 72 831 8062
Facsimile Number : +81 72 833 8069
Contact Person : Wataru Komine

SECTION 2: Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment : BT Module
Model No. : HRM1014
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC2.5-4.4V
Receipt Date of Sample : August 23, 2012
Country of Mass-production : China
Condition of EUT : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT : No Modification by the test lab

2.2 Product Description

Radio Specification

[Bluetooth]

Radio Type : Transceiver
Frequency of Operation : 2402-2480MHz
Modulation : FHSS
Power Supply (radio part input) : DC1.5/1.8V
Antenna type : Inverted F pattern antenna
Antenna Gain : 0dBi max

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2012, final revised on August 13, 2012 and effective September 12, 2012

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.247 Operation within the bands 902-928MHz,
2400-2483.5MHz, and 5725-5850MHz

* The revision on August 13, 2012 does not affect the test specification applied to the EUT.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst Margin	Results	Remarks	
Conducted Emission	FCC: ANSI C63.4:2003 7. AC powerline conducted emission measurements IC: RSS-Gen 7.2.4	FCC: Section 15.207 ----- IC: RSS-Gen 7.2.4	QP 11.6dB, 1.02420MHz, L AV 1.8dB, 1.02420MHz, L	Complied	-	
Carrier Frequency Separation	FCC: FCC Public Notice DA 00-705 ----- IC: -	FCC: Section15.247(a)(1) ----- IC: RSS-210 A8.1 (b)	See data.	Complied	Conducted	
20dB Bandwidth	FCC: FCC Public Notice DA 00-705 ----- IC: -	FCC: Section15.247(a)(1) ----- IC: RSS-210 A8.1 (a)		-	Conducted	
Number of Hopping Frequency	FCC: FCC Public Notice DA 00-705 ----- IC: -	FCC: Section15.247(a)(1)(iii) ----- IC: RSS-210 A8.1 (d)		Complied	Conducted	
Dwell time	FCC: FCC Public Notice DA 00-705 ----- IC: -	FCC: Section15.247(a)(1)(iii) ----- IC: RSS-210 A8.1 (d)		Complied	Conducted	
Maximum Peak Output Power	FCC: FCC Public Notice DA 00-705 ----- IC: RSS-Gen 4.8	FCC: Section15.247(a)(b)(1) ----- IC: RSS-210 A8.4 (2)		Complied	Conducted	
Spurious Emission & Band Edge Compliance	FCC: FCC Public Notice DA 00-705 ----- IC: RSS-Gen 4.9	FCC: Section15.247(d) ----- IC: RSS-210 A8.5 RSS-Gen 6 and 7.2.3		12.2dB 84.477MHz, QP, Hori.	Complied	Conducted/ Radiated

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.

* In case any questions arise about test procedure, ANSI C63.4: 2003 is also referred.

FCC 15.31 (e)

The RF Module has its own regulator.

The RF Module is constantly provided voltage (DC1.5V/1.8V) through own regulator regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203/212 Antenna requirement

It is impossible for end users to replace the antenna, because it is soldered on the circuit board. Therefore the equipment complies with the requirement of 15.203/212.

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	IC: RSS-Gen 4.6.1	IC: RSS-Gen 4.6.1	N/A	-	Conducted

Other than above, no addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

EMI

The following uncertainties have been calculated to provide a confidence level of 95% using a coverage factor k=2.

Test room (semi-anechoic chamber)	Conducted emission (+dB)
	150kHz-30MHz
No.1	3.5dB
No.2	3.6dB
No.3	3.6dB
No.4	3.6dB

Test room (semi-anechoic chamber)	Radiated emission						
	(3m*)(+dB)				(1m*)(+dB)		(0.5m*)(+dB)
	9kHz -30MHz	30MHz -300MHz	300MHz -1GHz	1GHz -10GHz	10GHz -18GHz	18GHz -26.5GHz	26.5GHz -40GHz
No.1	4.3dB	5.0dB	5.1dB	4.9dB	5.8dB	4.4dB	4.3dB
No.2	4.3dB	5.2dB	5.1dB	5.0dB	5.7dB	4.3dB	4.2dB
No.3	4.6dB	5.0dB	5.1dB	5.0dB	5.7dB	4.5dB	4.2dB
No.4	4.8dB	5.2dB	5.0dB	5.0dB	5.7dB	5.2dB	4.2dB

*3m/1m/0.5m = Measurement distance

Power meter (+dB)	
Below 1GHz	Above 1GHz
1.0dB	1.0dB

Antenna terminal conducted emission and Power density (+dB)			Antenna terminal conducted emission (+dB)		Channel power (+dB)
Below 1GHz	1GHz-3GHz	3GHz-18GHz	18GHz-26.5GHz	26.5GHz-40GHz	
1.0dB	1.1dB	2.7dB	3.2dB	3.3dB	1.5dB

Conducted Emission test

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

Radiated emission test(3m)

The data listed in this test report has enough margin, more than the site margin.

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3.5 Test Location

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	FCC Registration Number	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms
No.1 semi-anechoic chamber	313583	2973C-1	19.2 x 11.2 x 7.7m	7.0 x 6.0m	No.1 Power source room
No.2 semi-anechoic chamber	655103	2973C-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	148738	2973C-3	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.3 Preparation room
No.3 shielded room	-	-	4.0 x 6.0 x 2.7m	N/A	-
No.4 semi-anechoic chamber	134570	2973C-4	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.4 Preparation room
No.4 shielded room	-	-	4.0 x 6.0 x 2.7m	N/A	-
No.5 semi-anechoic chamber	-	-	6.0 x 6.0 x 3.9m	6.0 x 6.0m	-
No.6 shielded room	-	-	4.0 x 4.5 x 2.7m	4.75 x 5.4 m	-
No.6 measurement room	-	-	4.75 x 5.4 x 3.0m	4.75 x 4.15 m	-
No.7 shielded room	-	-	4.7 x 7.5 x 2.7m	4.7 x 7.5m	-
No.8 measurement room	-	-	3.1 x 5.0 x 2.7m	N/A	-
No.9 measurement room	-	-	8.0 x 4.5 x 2.8m	2.0 x 2.0m	-
No.10 measurement room	-	-	2.6 x 2.8 x 2.5m	2.4 x 2.4m	-
No.11 measurement room	-	-	3.1 x 3.4 x 3.0m	2.4 x 3.4m	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

3.6 Data of EMI, Test instruments, and Test set up

Refer to APPENDIX.

SECTION 4: Operation of E.U.T. during testing

4.1 Operating Mode(s)

Bluetooth (BT): Transmitting (Tx), Payload: PRBS9

Details of Operating Mode(s)

Test Item	Mode	Tested frequency
Conducted Emission, Spurious Emission (Conducted/Radiated)	Tx (Hopping off) DH5, 3DH5	2402MHz 2441MHz 2480MHz
Carrier Frequency Separation	Tx (Hopping on) DH5, 3DH5	2402MHz 2441MHz 2480MHz
20dB Bandwidth	Tx (Hopping off) DH5, 3DH5	2402MHz 2441MHz 2480MHz
Number of Hopping Frequency	Tx (Hopping on) DH5, 3DH5	-
Dwell time	Tx (Hopping on), -DH1, DH3, DH5 -3DH1, 3DH3, 3DH5	-
Maximum Peak Output Power	Tx (Hopping off) DH5, 3DH5	2402MHz 2441MHz 2480MHz
Band Edge Compliance (Conducted)	Tx DH5, 3DH5 -Hopping on -Hopping off	2402MHz 2480MHz
99% Occupied Bandwidth	Tx DH5, 3DH5 -Hopping on -Hopping off	2402MHz 2441MHz 2480MHz
<p>*As a result of preliminary test, the formal test was performed with the above modes, which had the maximum payload length (except Dwell time test) *EUT has the power settings by the software as follows; Power settings: BDR: Ext.=255, Int.=46 EDR: Ext.=255, Int.=48 Software: CSR BlueSuite BlueTest3 Version 2.3.0.15 *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.</p>		

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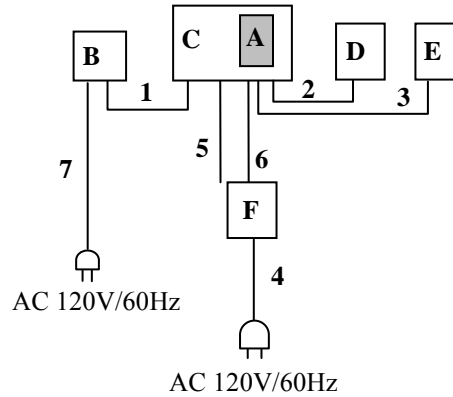
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4.2 Configuration and peripherals



* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	BT Module	HRM1014	001	Onkyo Corporation	EUT
B	AC Adapter	KSAS0652400 270M2	-	Ktec	-
C	LIVING SPEAKER SYSTEM	LAP-301	1115DCP2806000055 *1) 1115DCP2806000056 *2)	Onkyo Corporation	-
D	Dummy Load (4ohm)	-	-	-	-
E	Dummy Load (4ohm)	-	-	-	-
F	BLU-RAY DISK PLAYER	BD-SP808	3083UP5060650024	Onkyo Corporation	-

*1) Used for Antenna terminal conducted test

*2) Used for Conducted Emission/Radiated Emission tests

List of cables used

No.	Name	Length (m)	Cable Shield	Remarks
1	PC Cable	1.8	Unshielded	-
2	Speaker Out (L) Cable	1.0	Unshielded	-
3	Speaker Out (R) Cable	1.0	Unshielded	-
4	AC Power Cable	2.0	Unshielded	2 wires
5	Coaxial (IN) Cable	2.1	Shielded	-
6	Analog (IN) Cable	1.5	Shielded	-
7	AC Power Cable	2.0	Unshielded	2 wires

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SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 1.0m by 1.5m, raised 0.8m above the conducting ground plane.

The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80cm from a Line Impedance Stabilization Network (LISN)/ Artificial mains Network (AMN) and excess AC cable was bundled in center.

For the tests on EUT with other peripherals (as a whole system)

I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30cm to 40cm long and were hanged at a 40cm height to the ground plane. All unused 50ohm connectors of the LISN(AMN) were resistivity terminated in 50ohm when not connected to the measuring equipment.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber .

The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

The test results and limit are rounded off to one decimal place, so some differences might be observed.

Detector	: QP and AV
Measurement range	: 0.15-30MHz
Test data	: APPENDIX
Test result	: Pass

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SECTION 6: Radiated Spurious Emission

Test Procedure

EUT was placed on a urethane platform of nominal size, 1.5m by 1.0m, raised 0.8m above the conducting ground plane.

The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

The height of the measuring antenna varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.

The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.

The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode).

The test was made with the detector (RBW/VBW) in the following table.

When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

Test Antennas are used as below;

Frequency	Below 30MHz	30MHz to 300MHz	300MHz to 1GHz	Above 1GHz
Antenna Type	Loop	Biconical	Logperiodic	Horn

In any 100kHz bandwidth outside the restricted 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.

20dBc was applied to the frequency over the limit of FCC 15.209 / Table 5 of RSS-Gen 7.2.5 (IC) and outside the restricted band of FCC15.205 / Table 3 of RSS-Gen 7.2.2 (IC).

Frequency	Below 1GHz	Above 1GHz		20dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV	PK
IF Bandwidth	BW 120kHz(T/R)	RBW: 1MHz VBW: 3MHz	RBW: 1MHz VBW: 10Hz *1)	RBW: 100kHz VBW: 300kHz (S/A)
Test Distance	3m	3m (below 10GHz), 1m*2) (above 10GHz),		3m (below 10GHz), 1m*2) (above 10GHz),

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

*2) Distance Factor: $20 \times \log(3.0\text{m}/1.0\text{m}) = 9.5\text{dB}$

- 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.

The test results and limit are rounded off to one decimal place, so some differences might be observed.

Measurement range : 30M-25GHz
Test data : APPENDIX
Test result : Pass

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SECTION 7: Antenna Terminal Conducted Tests

Test Procedure

The tests were made with below setting connected to the antenna port.

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
20dB Bandwidth	3MHz	30kHz	100kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth	Enough width to display 20dB Bandwidth	1 to 3% of Span	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak	-	Power Meter (Sensor: 50MHz BW)
Carrier Frequency Separation	3MHz	30kHz	100kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Number of Hopping Frequency	30MHz	300kHz	1MHz	Auto	Peak	Max Hold	Spectrum Analyzer
Dwell Time	Zero Span	100kHz, 1MHz	300kHz, 3MHz	As necessary capture the entire dwell time per hopping channel	Peak	Max Hold	Spectrum Analyzer
Conducted Spurious Emission *1)	9kHz to 150kHz	200Hz	620Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	9.1kHz	27kHz				
	30MHz to 25GHz (Less or equal to 5GHz)	100kHz	300kHz				
Conducted Spurious Emission Band Edge compliance	20MHz	100kHz	300kHz	Auto	Peak	Max Hold	Spectrum Analyzer

*1) 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=9.1kHz)

The test results and limit are rounded off to two decimals place, so some differences might be observed.

Test data : **APPENDIX**
Test result : **Pass**

APPENDIX 1: Data of EMI test

Conducted Emission

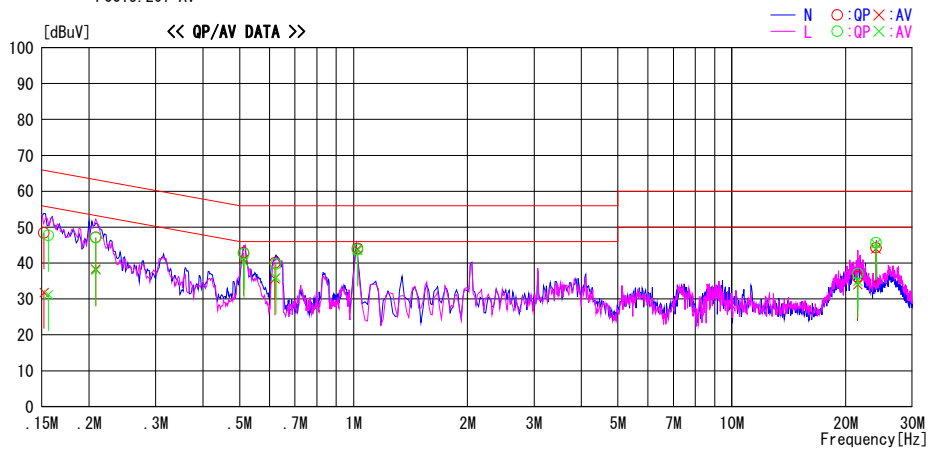
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No. 2 Semi Anechoic Chamber
Date : 2012/08/31

Report No. : 32LE0299-HO-01
Power : AC 120V / 60Hz
Temp./Humi. : 21deg. C / 64% RH
Engineer : Hiroshi Kukita

Mode / Remarks : Tx DH5 2402MHz

LIMIT : FCC15.207 QP
FCC15.207 AV

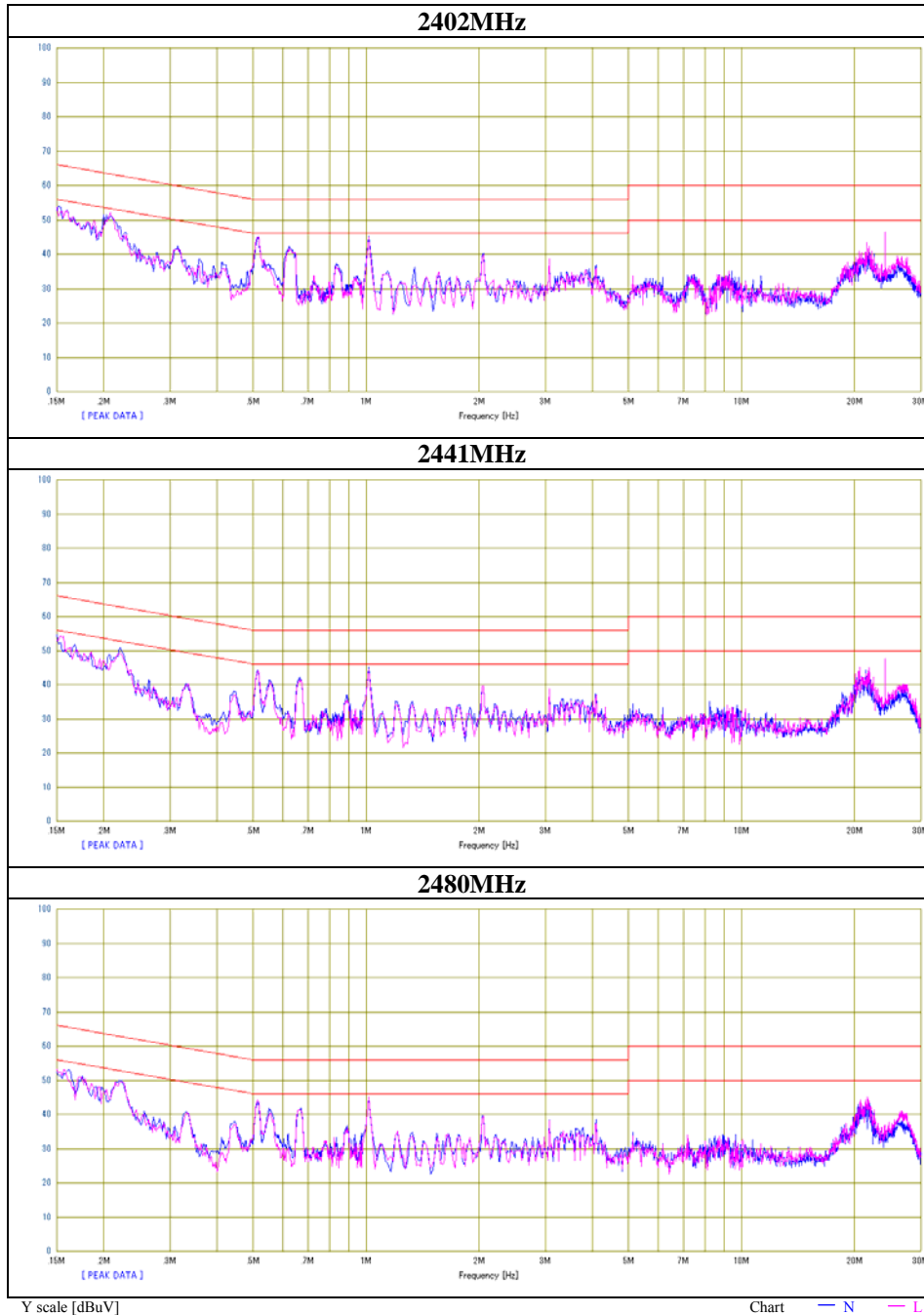


Frequency [MHz]	Reading Level		Corr. Factor	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15210	35.2	18.6	13.2	48.4	31.8	65.9	55.9	17.5	24.1	N	
0.20811	34.0	25.1	13.2	47.2	38.3	63.3	53.3	16.1	15.0	N	
0.51216	29.6	27.8	13.2	42.8	41.0	56.0	46.0	13.2	5.0	N	
0.62040	26.7	22.3	13.3	40.0	35.6	56.0	46.0	16.0	10.4	N	
1.02408	30.8	30.6	13.3	44.1	43.9	56.0	46.0	11.9	2.1	N	
21.50320	20.9	18.7	15.3	36.2	34.0	60.0	50.0	23.8	16.0	N	
24.05162	28.9	28.6	15.4	44.3	44.0	60.0	50.0	15.7	6.0	N	
0.15604	34.5	18.0	13.2	47.7	31.2	65.7	55.7	18.0	24.5	L	
0.20850	33.9	24.8	13.2	47.1	38.0	63.3	53.3	16.2	15.3	L	
0.51350	29.4	27.1	13.2	42.6	40.3	56.0	46.0	13.4	5.7	L	
0.62370	26.4	22.7	13.3	39.7	36.0	56.0	46.0	16.3	10.0	L	
1.02480	30.5	30.3	13.3	43.8	43.6	56.0	46.0	12.2	2.4	L	
21.52190	21.8	19.6	15.3	37.1	34.9	60.0	50.0	22.9	15.1	L	
24.05112	30.3	30.0	15.4	45.7	45.4	60.0	50.0	14.3	4.6	L	

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

Conducted Emission

Test place	Head Office EMC Lab. No.2 Semi Anechoic Chamber
Report No.	32LE0299-HO-01
Date	08/31/2012
Temperature/ Humidity	21 deg.C/ 64% RH
Engineer	Hiroshi Kukita
Mode	Tx DH5



Conducted Emission

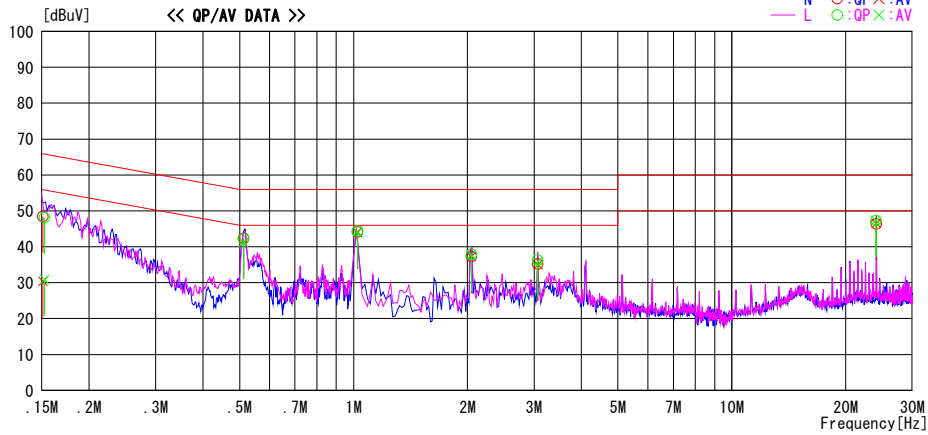
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No. 2 Semi Anechoic Chamber
Date : 2012/08/31

Report No. : 32LE0299-HO-01
Power : AC 120V / 60Hz
Temp./Humi. : 21deg. C / 64% RH
Engineer : Hiroshi Kukita

Mode / Remarks : Tx 3DH5 2441MHz

LIMIT : FCC15.207 QP
FCC15.207 AV

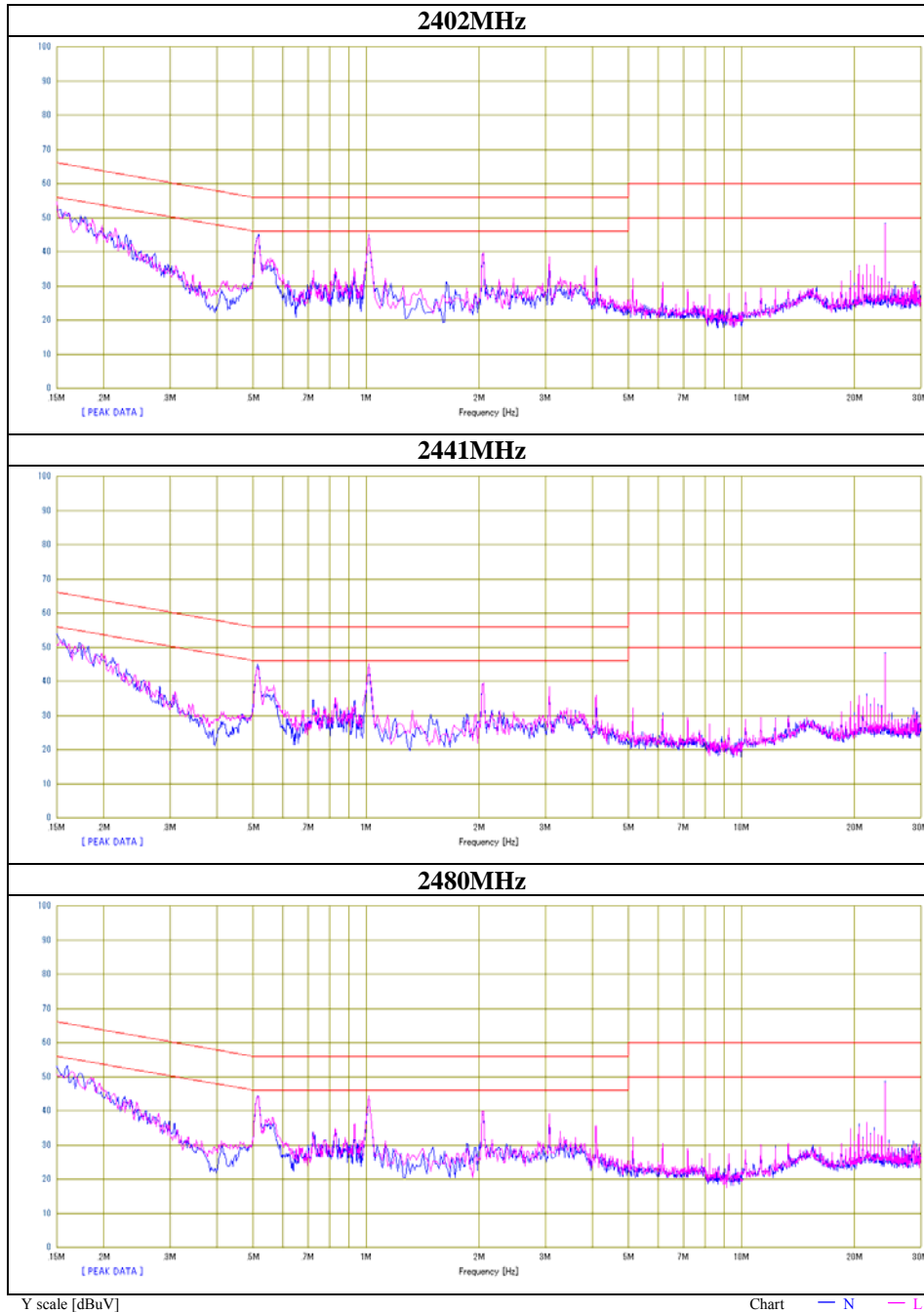


Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15098	35.2	17.2	13.2	48.4	30.4	65.9	55.9	17.5	25.5	N	
0.51238	29.1	28.0	13.2	42.3	41.2	56.0	46.0	13.7	4.8	N	
1.02398	30.9	30.7	13.3	44.2	44.0	56.0	46.0	11.8	2.0	N	
2.04806	23.9	23.8	13.4	37.3	37.2	56.0	46.0	18.7	8.8	N	
3.07220	21.6	21.4	13.6	35.2	35.0	56.0	46.0	20.8	11.0	N	
24.09343	31.0	31.1	15.4	46.4	46.5	60.0	50.0	13.6	3.5	N	
0.15256	34.9	17.7	13.2	48.1	30.9	65.9	55.9	17.8	25.0	L	
0.51235	28.9	28.0	13.2	42.1	41.2	56.0	46.0	13.9	4.8	L	
1.02420	31.1	30.9	13.3	44.4	44.2	56.0	46.0	11.6	1.8	L	
2.04797	24.5	24.3	13.4	37.9	37.7	56.0	46.0	18.1	8.3	L	
3.07200	22.7	22.3	13.6	36.3	35.9	56.0	46.0	19.7	10.1	L	
24.05200	31.9	32.0	15.4	47.3	47.4	60.0	50.0	12.7	2.6	L	

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

Conducted Emission

Test place	Head Office EMC Lab. No.2 Semi Anechoic Chamber
Report No.	32LE0299-HO-01
Date	08/31/2012
Temperature/ Humidity	21 deg.C/ 64% RH
Engineer	Hiroshi Kukita
Mode	Tx 3DH5



20dB Bandwidth and Carrier Frequency Separation

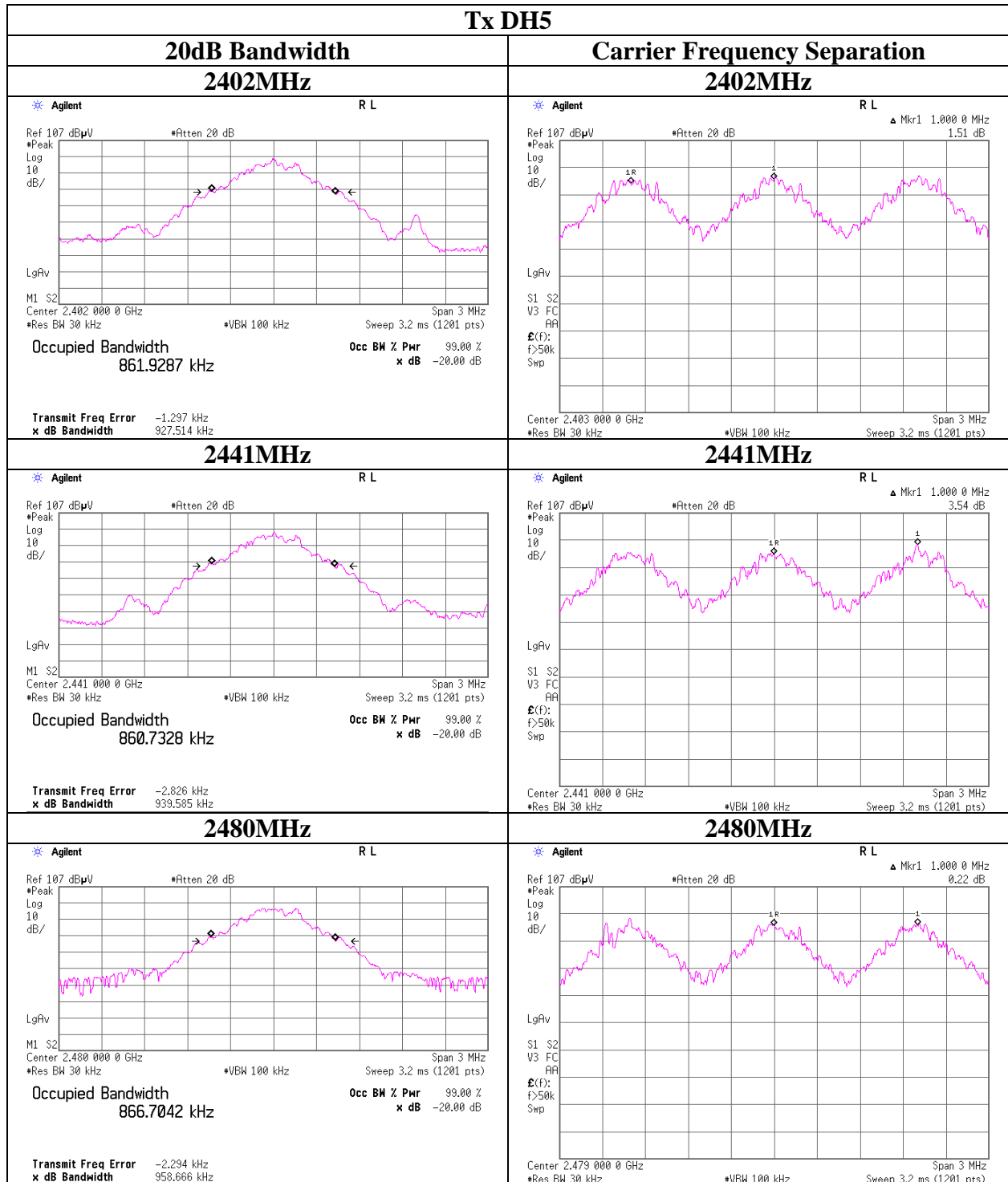
Test place Head Office EMC Lab. No.7 Shielded Room
Report No. 32LE0299-HO-01
Date 09/04/2012
Temperature/ Humidity 24 deg. C / 62% RH
Engineer Takumi Shimada
Mode Tx (Hopping on) DH5/3DH5

Mode	Freq. [MHz]	20dB Bandwidth [MHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	0.928	1.000	≥ 0.618
DH5	2441.0	0.940	1.000	≥ 0.626
DH5	2480.0	0.959	1.000	≥ 0.639
3DH5	2402.0	1.308	1.000	≥ 0.872
3DH5	2441.0	1.265	1.000	≥ 0.843
3DH5	2480.0	1.306	1.000	≥ 0.871

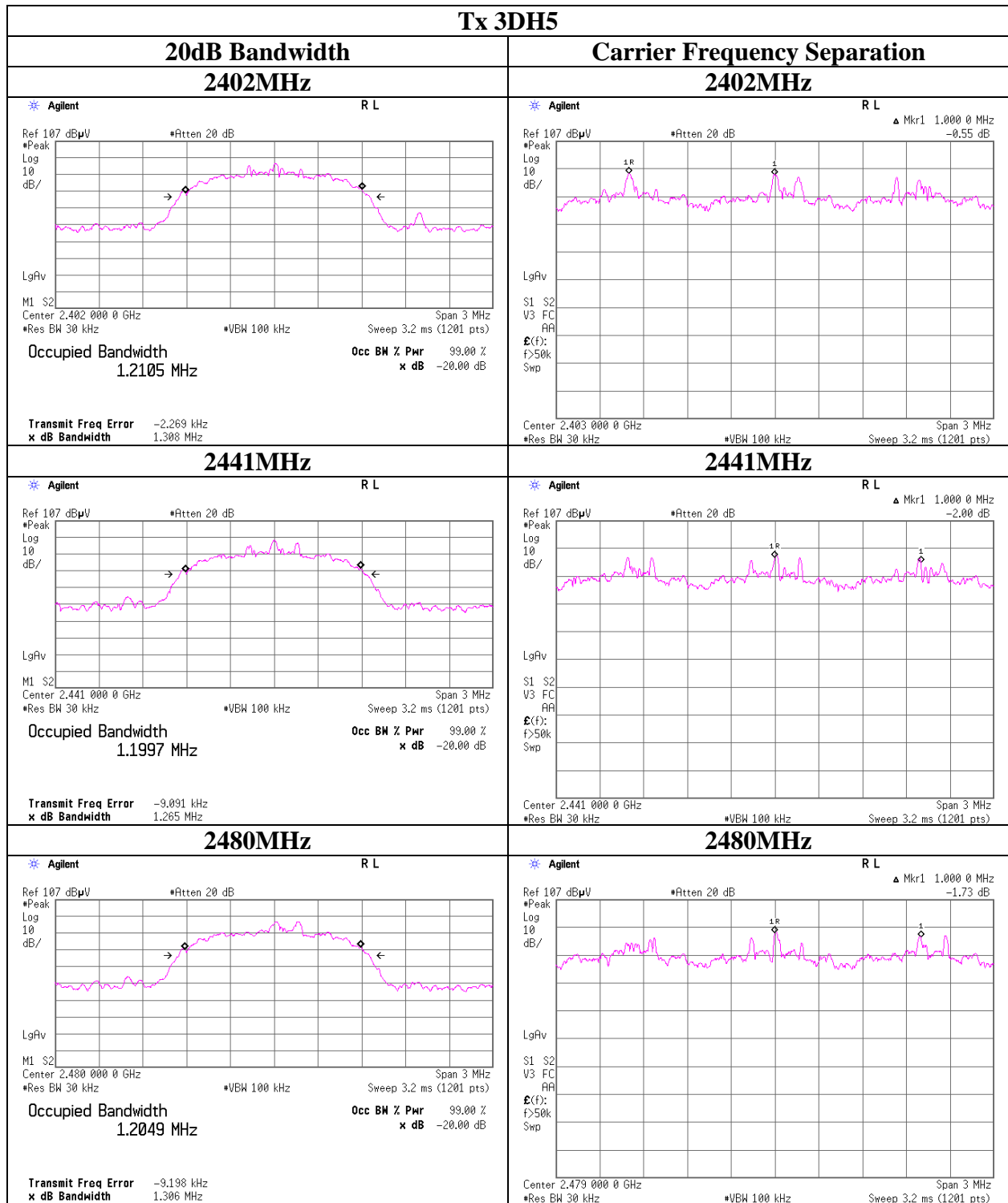
Limit: Two-thirds of 20dB Bandwidth or 25kHz (whichever is greater).

No limit applies to 20dB Bandwidth.

20dB Bandwidth and Carrier Frequency Separation



20dB Bandwidth and Carrier Frequency Separation



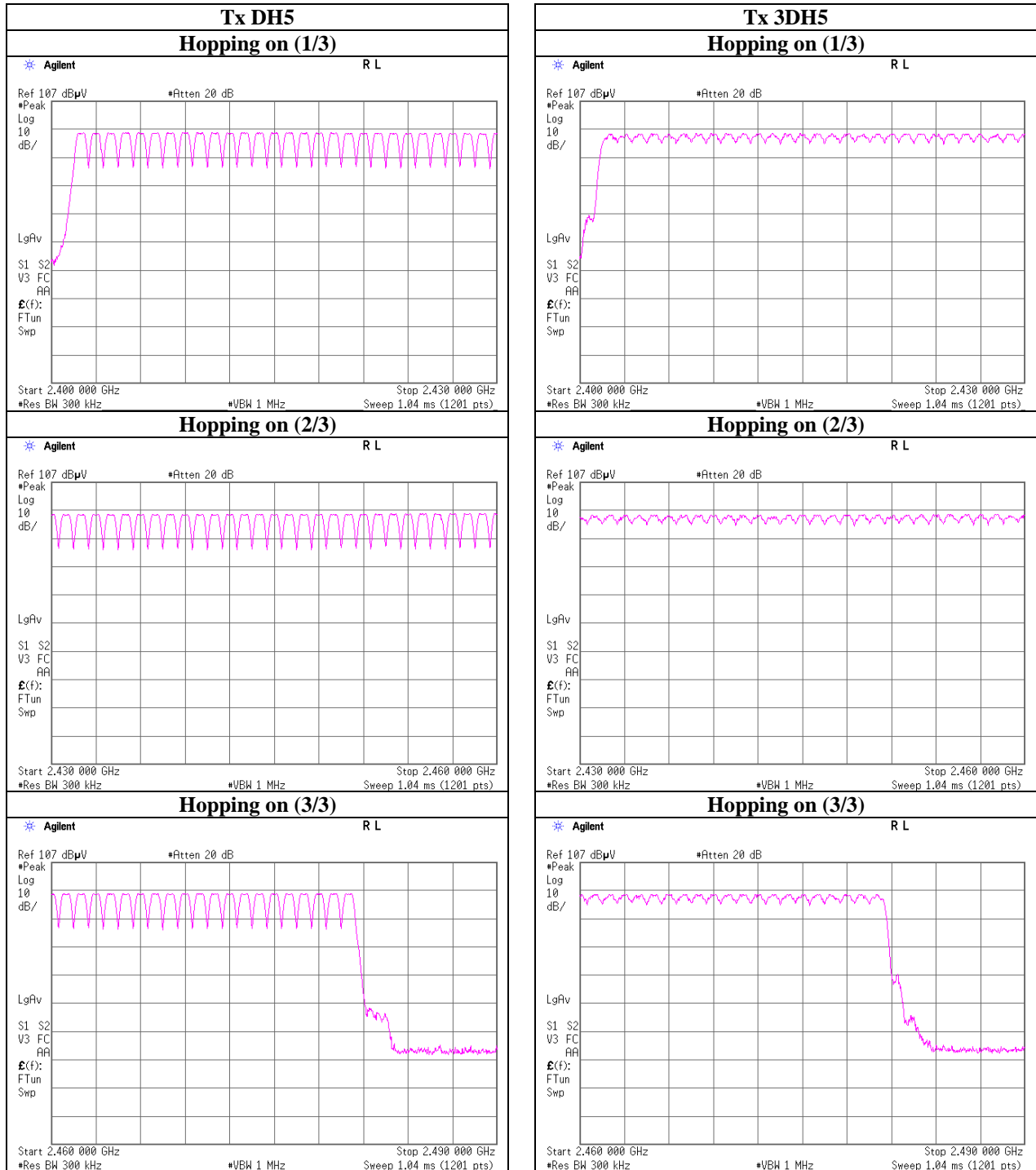
Number of Hopping Frequency

Test place Head Office EMC Lab. No.7 Shielded Room
Report No. 32LE0299-HO-01
Date 09/04/2012
Temperature/ Humidity 24 deg. C / 62% RH
Engineer Takumi Shimada
Mode Tx (Hopping on) DH5/3DH5

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

Number of Hopping Frequency



Dwell time

Test place Head Office EMC Lab. No.7 Shielded Room
Report No. 32LE0299-HO-01
Date 09/04/2012
Temperature/ Humidity 24 deg. C / 62% RH
Engineer Takumi Shimada
Mode Tx (Hopping on) DH5/3DH5

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	0.521	168	400
DH3	25.0 times /	5 sec. x	31.6 sec. = 158 times	1.796	284	400
DH5	17.0 times /	5 sec. x	31.6 sec. = 108 times	3.037	328	400
3DH1	51.0 times /	5 sec. x	31.6 sec. = 323 times	0.537	173	400
3DH3	25.0 times /	5 sec. x	31.6 sec. = 158 times	1.786	282	400
3DH5	17.0 times /	5 sec. x	31.6 sec. = 108 times	3.049	329	400

Sample Calculation

Result = Number of transmission x Length of transmission time

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. This is confirmed in the test report for $N=79$.

UL Japan, Inc.

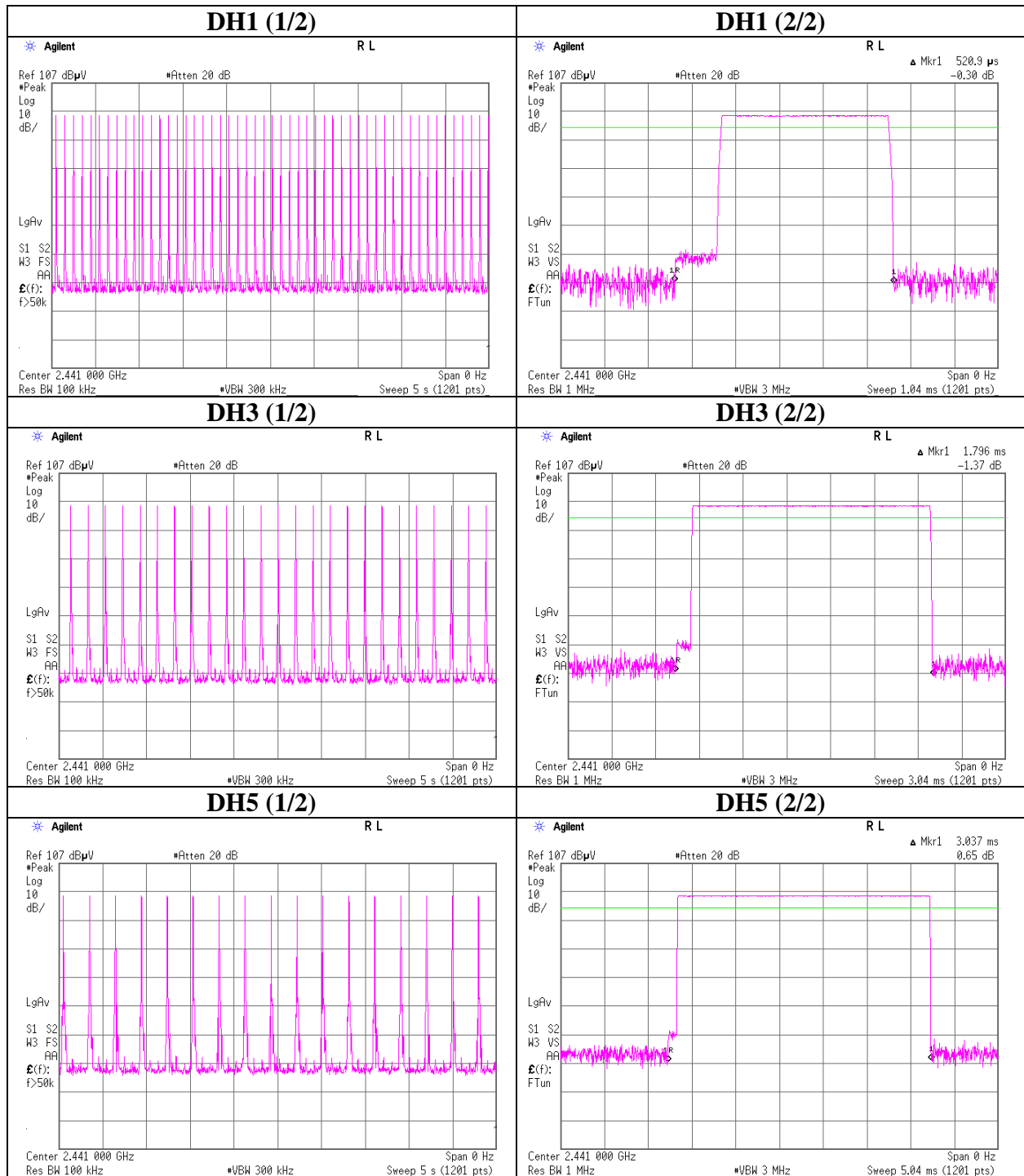
Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

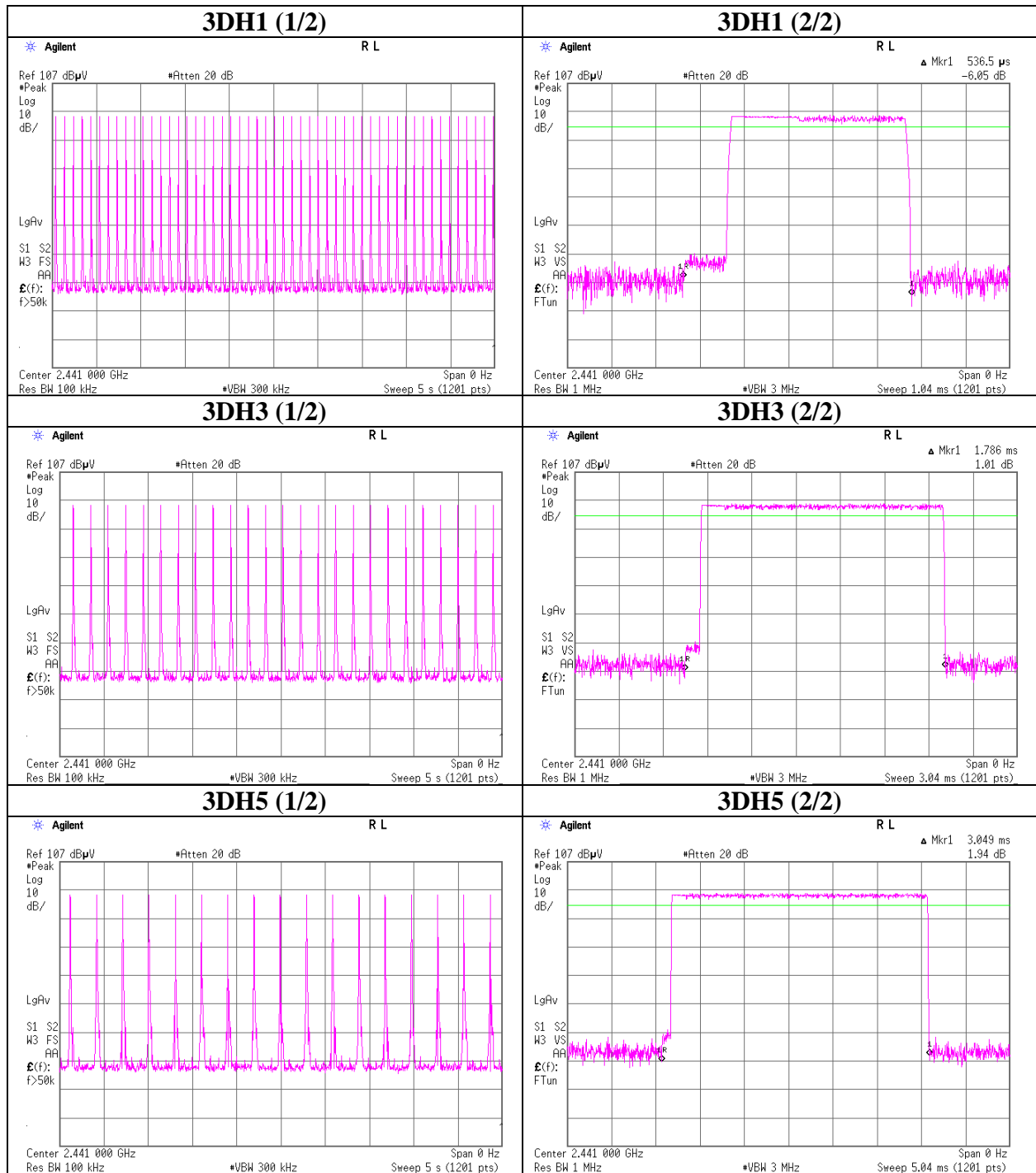
Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

Dwell time



Dwell time



Maximum Peak Output Power

Test place Head Office EMC Lab. No.7 Shielded Room
Report No. 32LE0299-HO-01
Date 09/04/2012
Temperature/ Humidity 24 deg. C / 62% RH
Engineer Takumi Shimada
Mode Tx (Hopping off) DH5/3DH5

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
					[dBm]	[mW]	[dBm]	[mW]	
DH5	2402.0	-11.17	1.75	9.95	0.53	1.13	20.96	125	20.43
DH5	2441.0	-11.38	1.76	9.95	0.33	1.08	20.96	125	20.63
DH5	2480.0	-10.97	1.77	9.95	0.75	1.19	20.96	125	20.21
3DH5	2402.0	-10.75	1.75	9.95	0.95	1.25	20.96	125	20.01
3DH5	2441.0	-10.84	1.76	9.95	0.87	1.22	20.96	125	20.09
3DH5	2480.0	-10.47	1.77	9.95	1.25	1.33	20.96	125	19.71

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.

Radiated Spurious Emission

Test place Head Office EMC Lab. No.3 Semi Anechoic Chamber
Report No. 32LE0299-HO-01
Date 08/27/2012 08/28/2012
Temperature/ Humidity 24 deg.C/ 63% RH 24 deg.C/ 61% RH
Engineer Takumi Shimada Takumi Shimada
(Above 1GHz) (Below 1GHz)
Mode Tx, 3DH5 2402MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	50.169	QP	30.8	11.0	7.5	32.2	17.1	40.0	22.9	
Hori	62.461	QP	33.4	7.7	7.6	32.2	16.5	40.0	23.5	
Hori	84.469	QP	44.6	7.3	7.9	32.2	27.6	40.0	12.4	
Hori	89.093	QP	35.9	8.2	8.0	32.2	19.9	43.5	23.6	
Hori	393.201	QP	36.1	17.5	10.6	32.1	32.1	46.0	13.9	
Hori	562.152	QP	27.7	19.0	11.7	32.0	26.4	46.0	19.6	
Hori	2390.000	PK	45.5	27.4	2.2	32.4	42.7	73.9	31.2	
Hori	4804.000	PK	47.1	31.6	4.7	31.4	52.0	73.9	21.9	
Hori	7206.000	PK	41.7	36.3	5.6	32.4	51.2	73.9	22.7	
Hori	9608.000	PK	42.3	38.1	6.7	33.0	54.1	73.9	19.8	
Vert	50.173	QP	38.8	11.0	7.5	32.2	25.1	40.0	14.9	
Vert	62.459	QP	38.6	7.7	7.6	32.2	21.7	40.0	18.3	
Vert	84.472	QP	41.8	7.3	7.9	32.2	24.8	40.0	15.2	
Vert	89.092	QP	35.0	8.2	8.0	32.2	19.0	43.5	24.5	
Vert	393.202	QP	35.9	17.5	10.6	32.1	31.9	46.0	14.1	
Vert	562.150	QP	27.4	19.0	11.7	32.0	26.1	46.0	19.9	
Vert	2390.000	PK	45.1	27.4	2.2	32.4	42.3	73.9	31.6	
Vert	4804.000	PK	50.6	31.6	4.7	31.4	55.5	73.9	18.4	
Vert	7206.000	PK	41.8	36.3	5.6	32.4	51.3	73.9	22.6	
Vert	9608.000	PK	43.0	38.1	6.7	33.0	54.8	73.9	19.1	

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).

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

Radiated Spurious Emission

Test place Head Office EMC Lab. No.3 Semi Anechoic Chamber
Report No. 32LE0299-HO-01
Date 08/27/2012
Temperature/ Humidity 24 deg.C/ 63% RH
Engineer Takumi Shimada
(Above 1GHz)
Mode Tx, 3DH5 2402MHz

20dBc Data Sheet

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	103.8	27.4	2.2	32.4	101.0	-	-	Carrier
Hori	2399.487	PK	57.3	27.4	2.2	32.4	54.5	81.0	26.5	
Hori	2400.000	PK	59.2	27.4	2.2	32.4	56.4	81.0	24.6	
Vert	2402.000	PK	102.3	27.4	2.2	32.4	99.5	-	-	Carrier
Vert	2399.483	PK	55.8	27.4	2.2	32.4	53.0	79.5	26.5	
Vert	2400.000	PK	57.6	27.4	2.2	32.4	54.8	79.5	24.7	

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

Dwell time factor relaxation

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	32.5	27.4	2.2	32.4	-24.2	5.5	53.9	48.4	
Hori	4804.000	AV	37.2	31.6	4.7	31.4	-24.2	17.9	53.9	36.0	
Hori	7206.000	AV	29.9	36.3	5.6	32.4	-24.2	15.2	53.9	38.7	
Hori	9608.000	AV	30.3	38.1	6.7	33.0	-24.2	17.9	53.9	36.0	
Vert	2390.000	AV	32.1	27.4	2.2	32.4	-24.2	5.1	53.9	48.8	
Vert	4804.000	AV	41.4	31.6	4.7	31.4	-24.2	22.1	53.9	31.8	
Vert	7206.000	AV	29.7	36.3	5.6	32.4	-24.2	15.0	53.9	38.9	
Vert	9608.000	AV	30.3	38.1	6.7	33.0	-24.2	17.9	53.9	36.0	

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

- Gain(Amplifier) + Dwell time factor (Refer to dwell time data sheet)

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

Radiated Spurious Emission

Test place Head Office EMC Lab. No.3 Semi Anechoic Chamber
Report No. 32LE0299-HO-01
Date 08/27/2012 08/28/2012
Temperature/ Humidity 24 deg.C/ 63% RH 24 deg.C/ 61% RH
Engineer Takumi Shimada Takumi Shimada
(Above 1GHz) (Below 1GHz)
Mode Tx, 3DH5 2480MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	50.178	QP	26.7	11.0	7.5	32.2	13.0	40.0	27.0	
Hori	60.418	QP	40.3	8.0	7.6	32.2	23.7	40.0	16.3	
Hori	84.478	QP	43.9	7.3	7.9	32.2	26.9	40.0	13.1	
Hori	89.084	QP	35.0	8.2	8.0	32.2	19.0	43.5	24.5	
Hori	393.202	QP	36.6	17.5	10.6	32.1	32.6	46.0	13.4	
Hori	562.150	QP	27.4	19.0	11.7	32.0	26.1	46.0	19.9	
Hori	2483.500	PK	55.7	27.7	2.2	32.3	53.3	73.9	20.6	
Hori	4960.000	PK	46.7	32.2	4.7	31.4	52.2	73.9	21.7	
Hori	7440.000	PK	42.6	36.7	5.7	32.6	52.4	73.9	21.5	
Hori	9920.000	PK	43.1	38.6	6.8	33.1	55.4	73.9	18.5	
Vert	50.178	QP	35.1	11.0	7.5	32.2	21.4	40.0	18.6	
Vert	60.415	QP	41.2	8.0	7.6	32.2	24.6	40.0	15.4	
Vert	84.482	QP	41.1	7.3	7.9	32.2	24.1	40.0	15.9	
Vert	89.088	QP	34.3	8.2	8.0	32.2	18.3	43.5	25.2	
Vert	393.201	QP	35.7	17.5	10.6	32.1	31.7	46.0	14.3	
Vert	562.154	QP	27.3	19.0	11.7	32.0	26.0	46.0	20.0	
Vert	2483.500	PK	61.4	27.7	2.2	32.3	59.0	73.9	14.9	
Vert	4960.000	PK	48.7	32.2	4.7	31.4	54.2	73.9	19.7	
Vert	7440.000	PK	42.6	36.7	5.7	32.6	52.4	73.9	21.5	
Vert	9920.000	PK	42.6	38.6	6.8	33.1	54.9	73.9	19.0	

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).

Distance factor: 10GHz-26.5GHz $20\log(3.0m/1.0m) = 9.5dB$

Dwell time factor relaxation

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	41.2	27.7	2.2	32.3	-24.2	14.6	53.9	39.3	
Hori	4960.000	AV	37.0	32.2	4.7	31.4	-24.2	18.3	53.9	35.6	
Hori	7440.000	AV	30.2	36.7	5.7	32.6	-24.2	15.8	53.9	38.1	
Hori	9920.000	AV	30.0	38.6	6.8	33.1	-24.2	18.1	53.9	35.8	
Vert	2483.500	AV	40.6	27.7	2.2	32.3	-24.2	14.0	53.9	39.9	
Vert	4960.000	AV	39.6	32.2	4.7	31.4	-24.2	20.9	53.9	33.0	
Vert	7440.000	AV	30.1	36.7	5.7	32.6	-24.2	15.7	53.9	38.2	
Vert	9920.000	AV	30.1	38.6	6.8	33.1	-24.2	18.2	53.9	35.7	

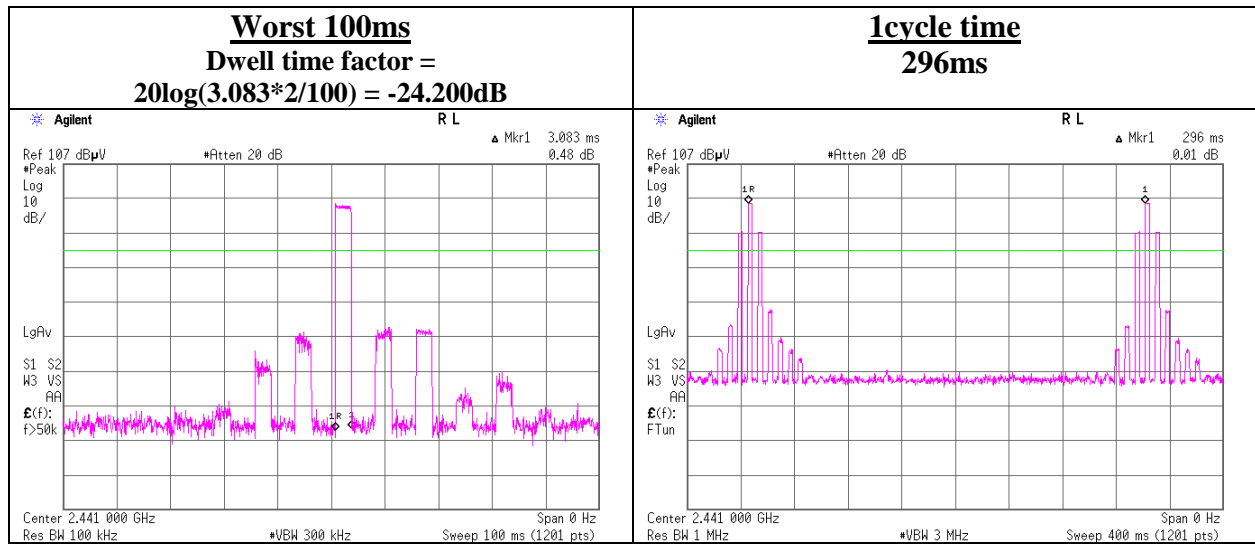
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz))

- Gain(Amplifier) + Dwell time factor (Refer to dwell time data sheet)

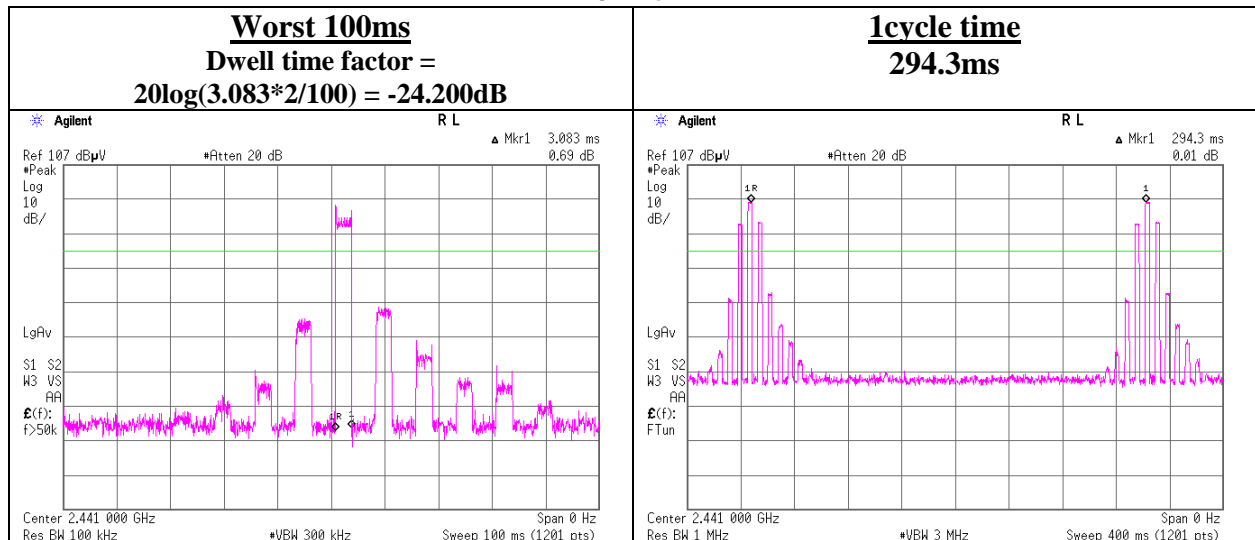
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

Dwell time factor

DH5

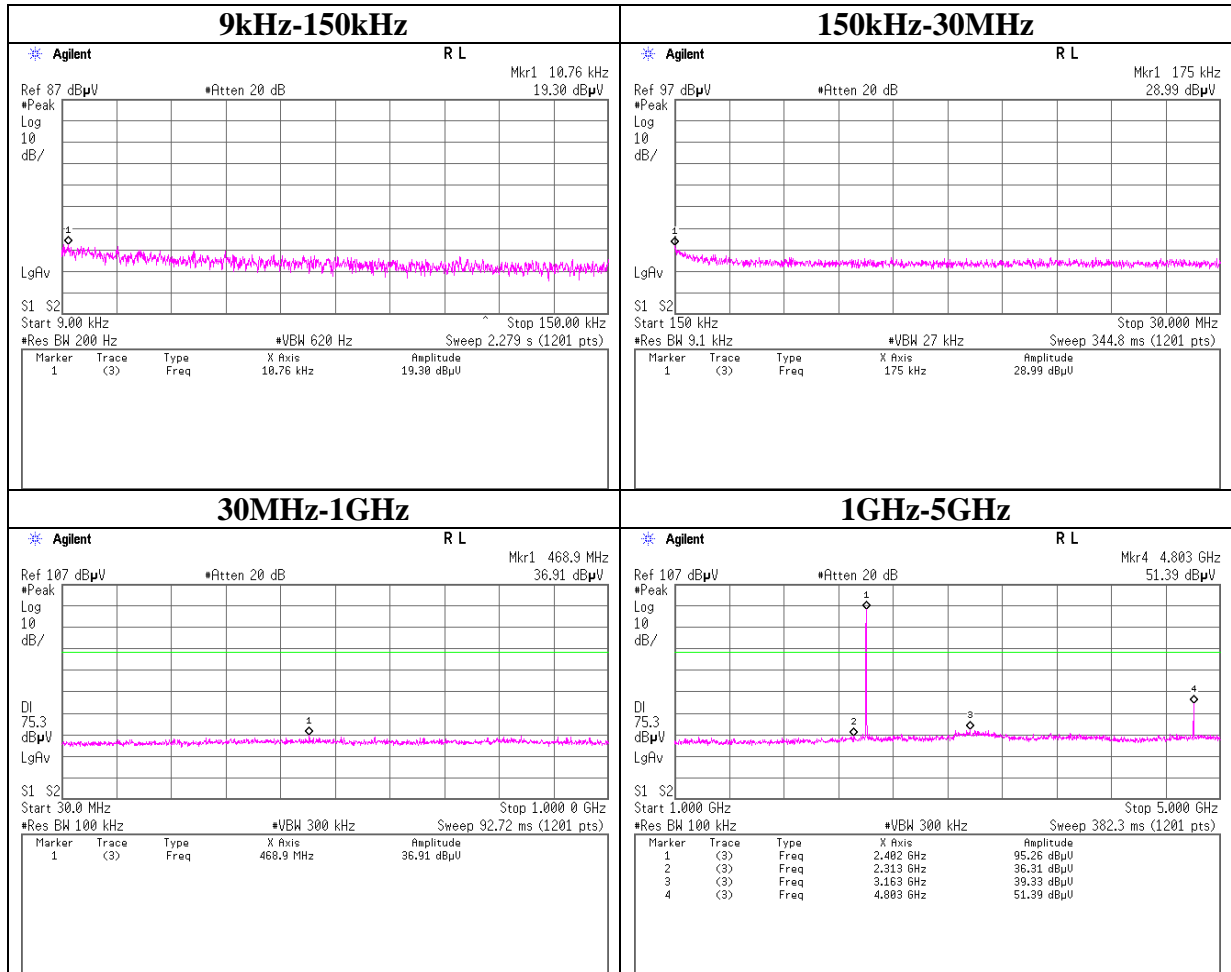


3DH5



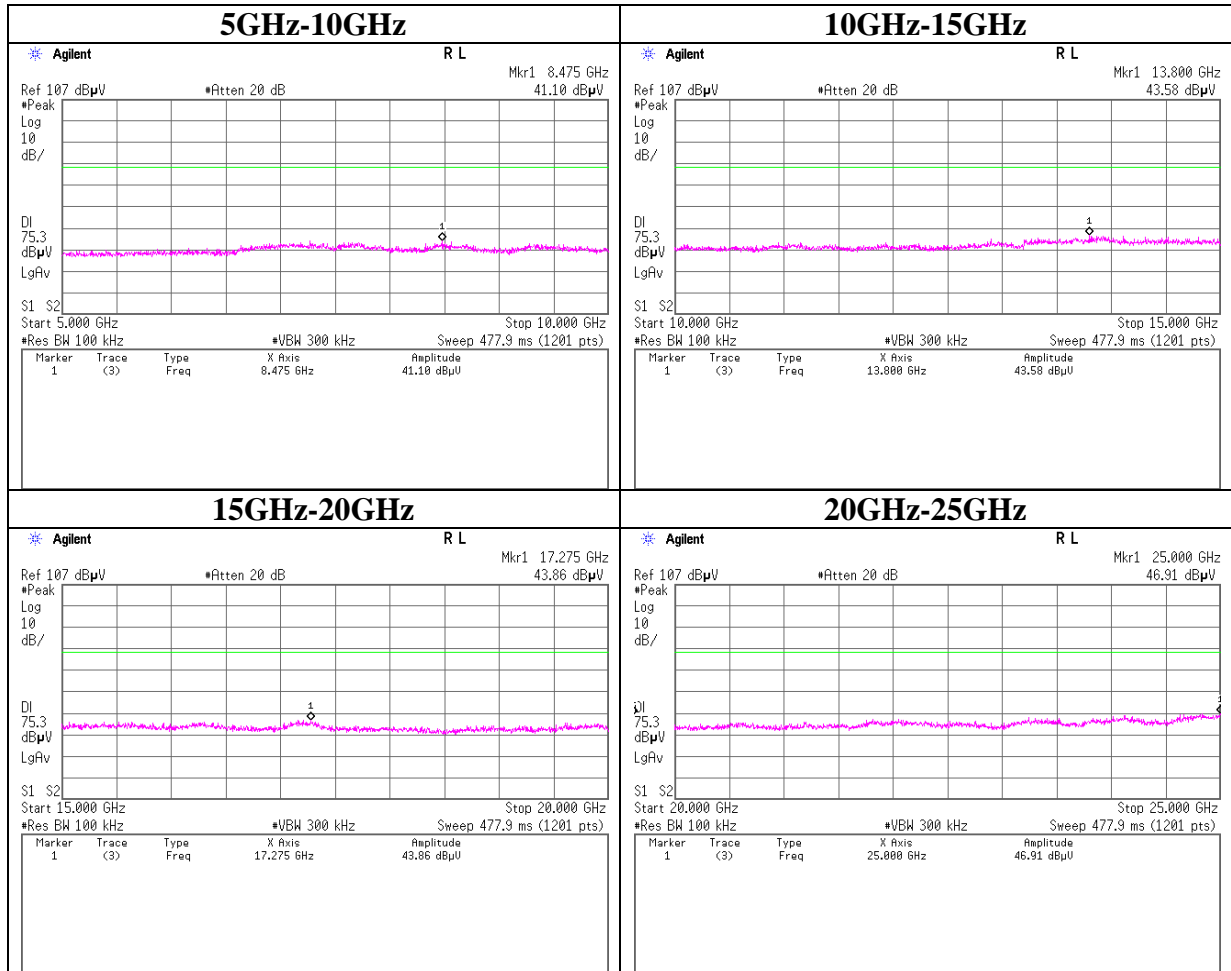
Conducted Spurious Emission

Tx DH5 2402MHz



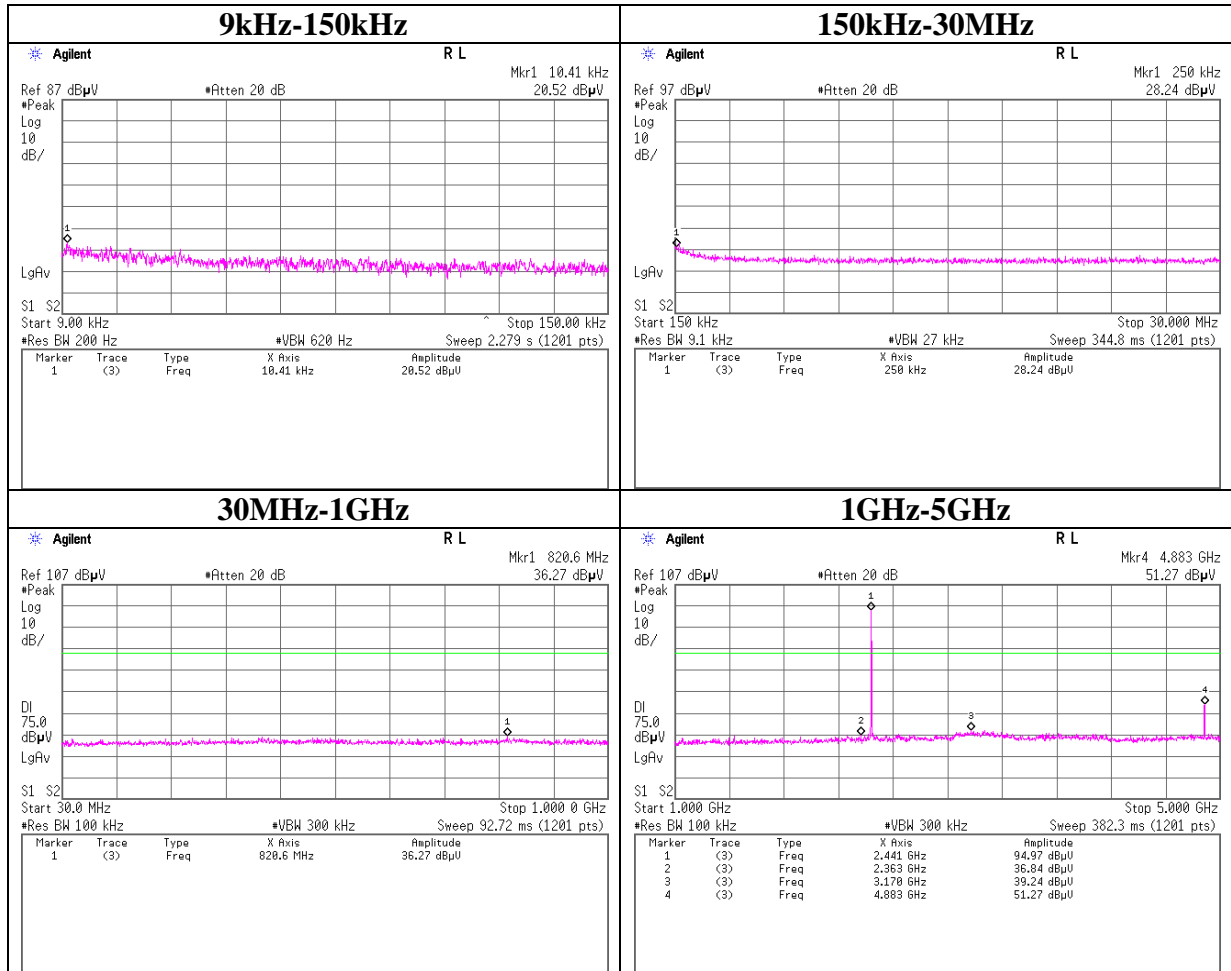
Conducted Spurious Emission

Tx DH5 2402MHz



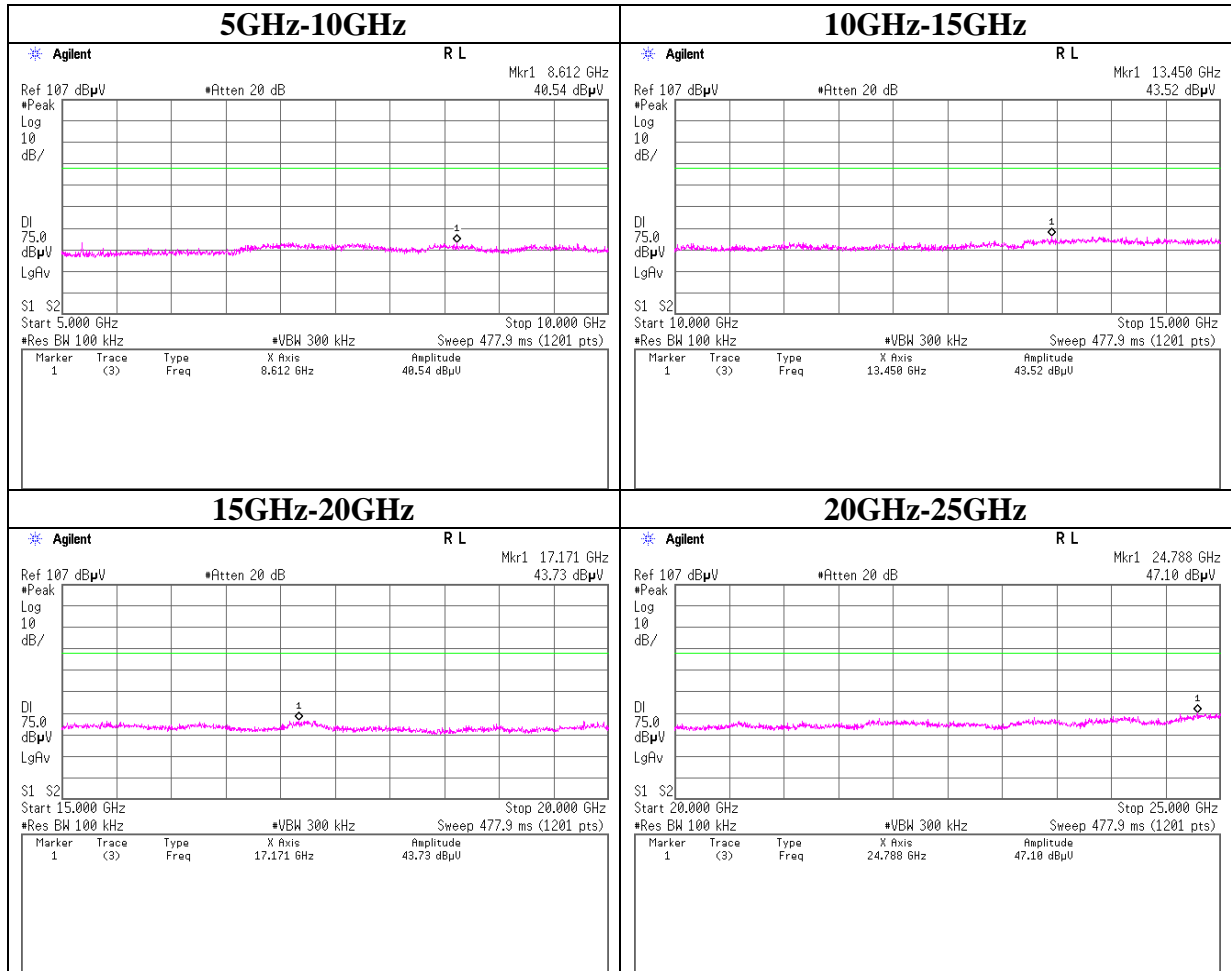
Conducted Spurious Emission

Tx DH5 2441MHz



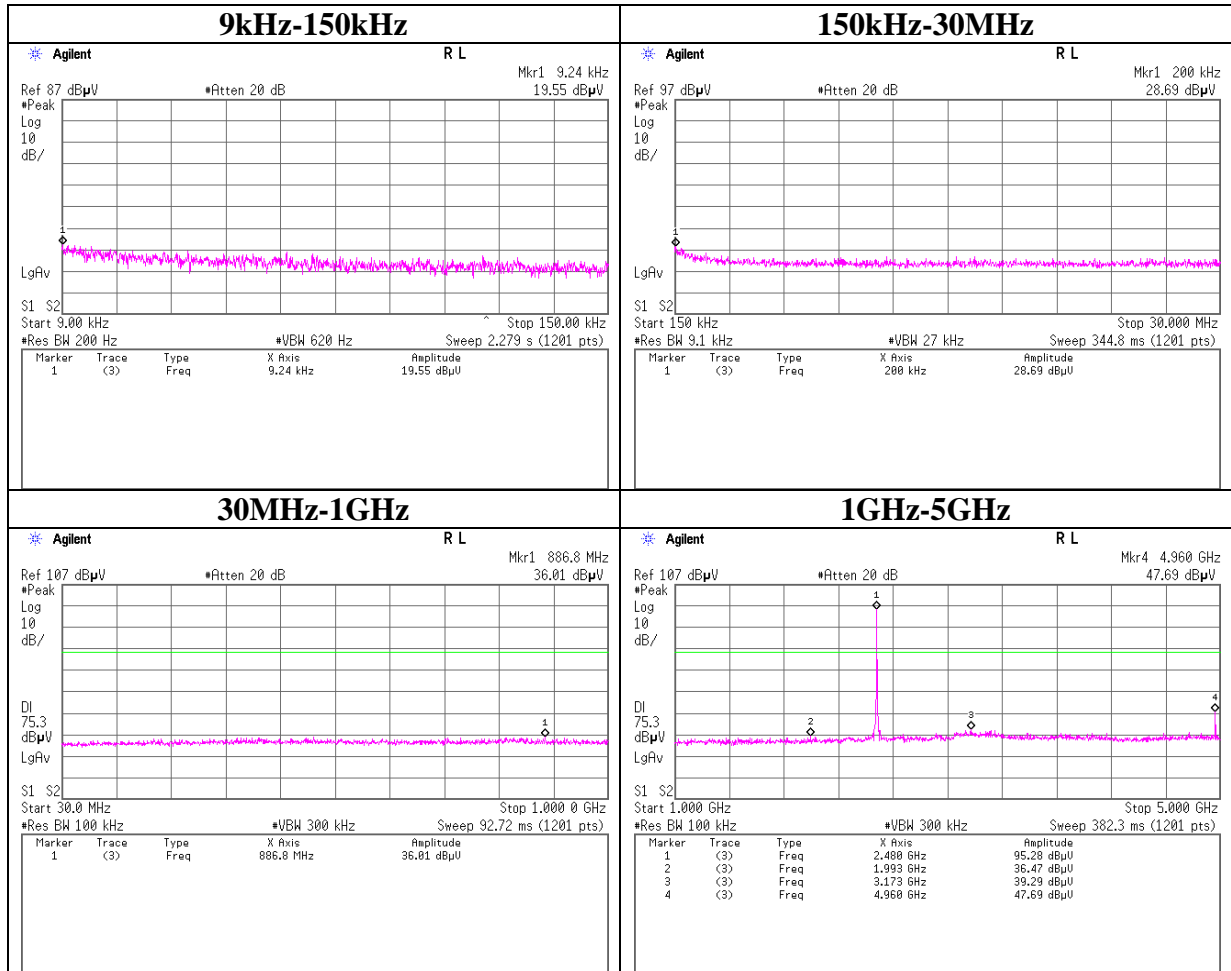
Conducted Spurious Emission

Tx DH5 2441MHz



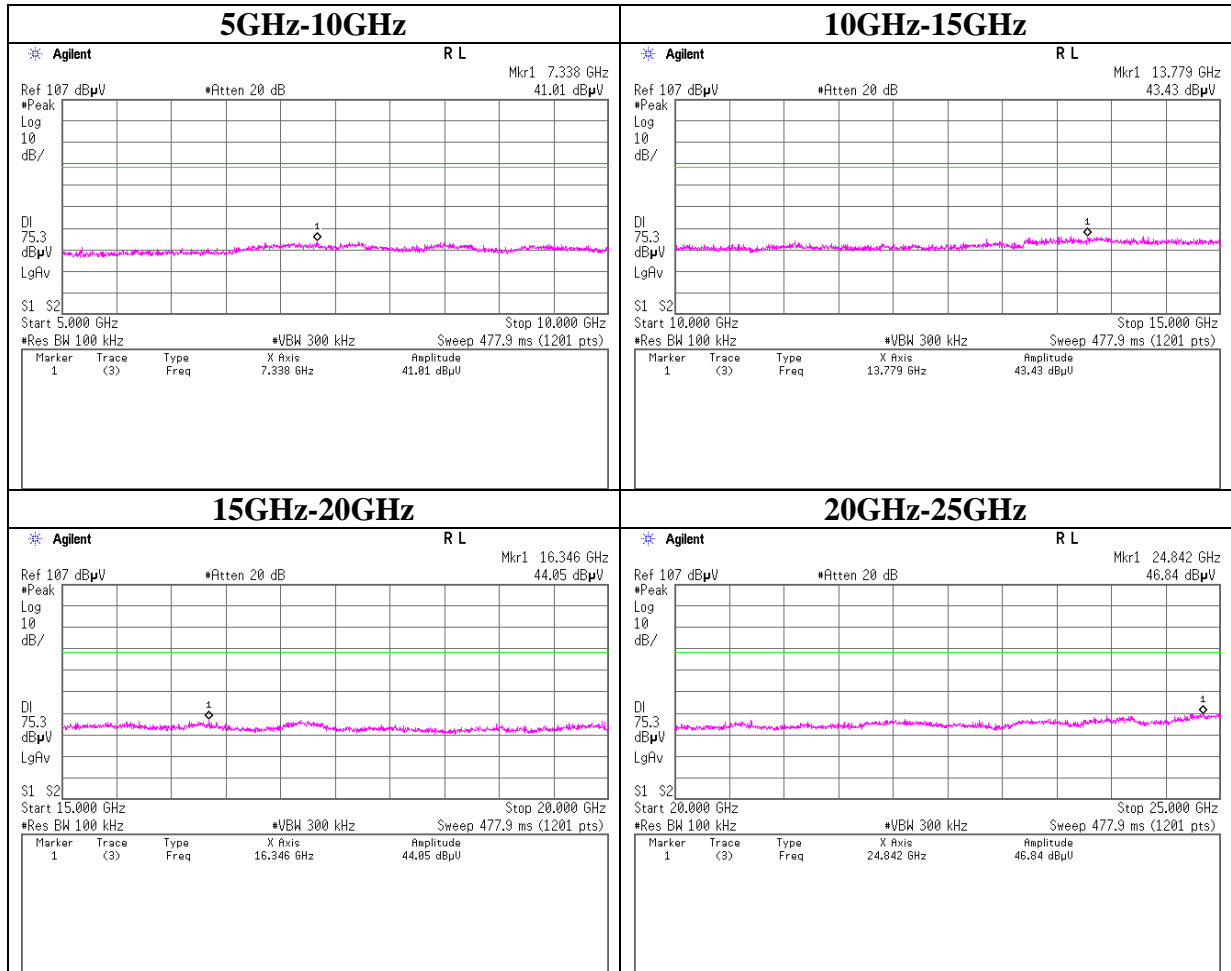
Conducted Spurious Emission

Tx DH5 2480MHz



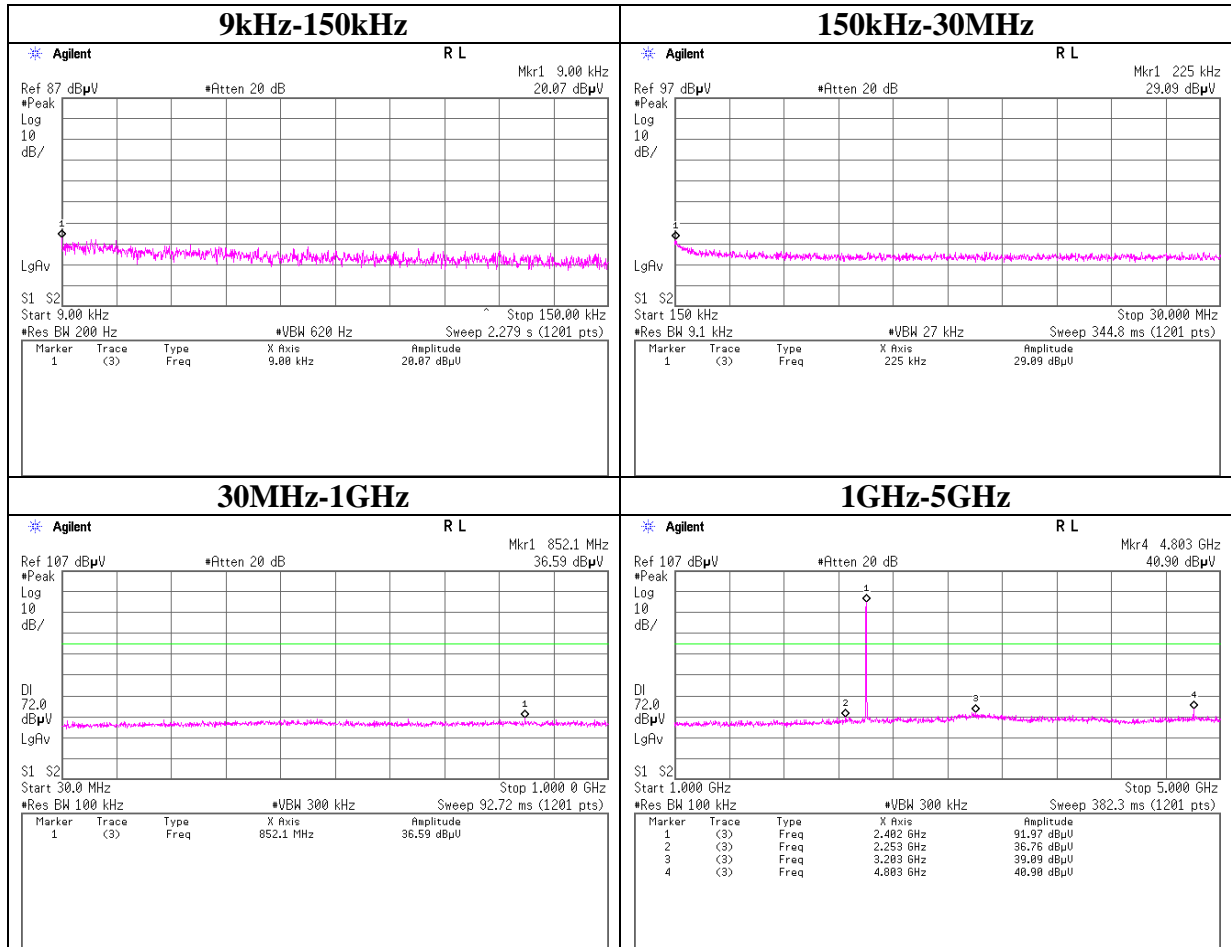
Conducted Spurious Emission

Tx DH5 2480MHz



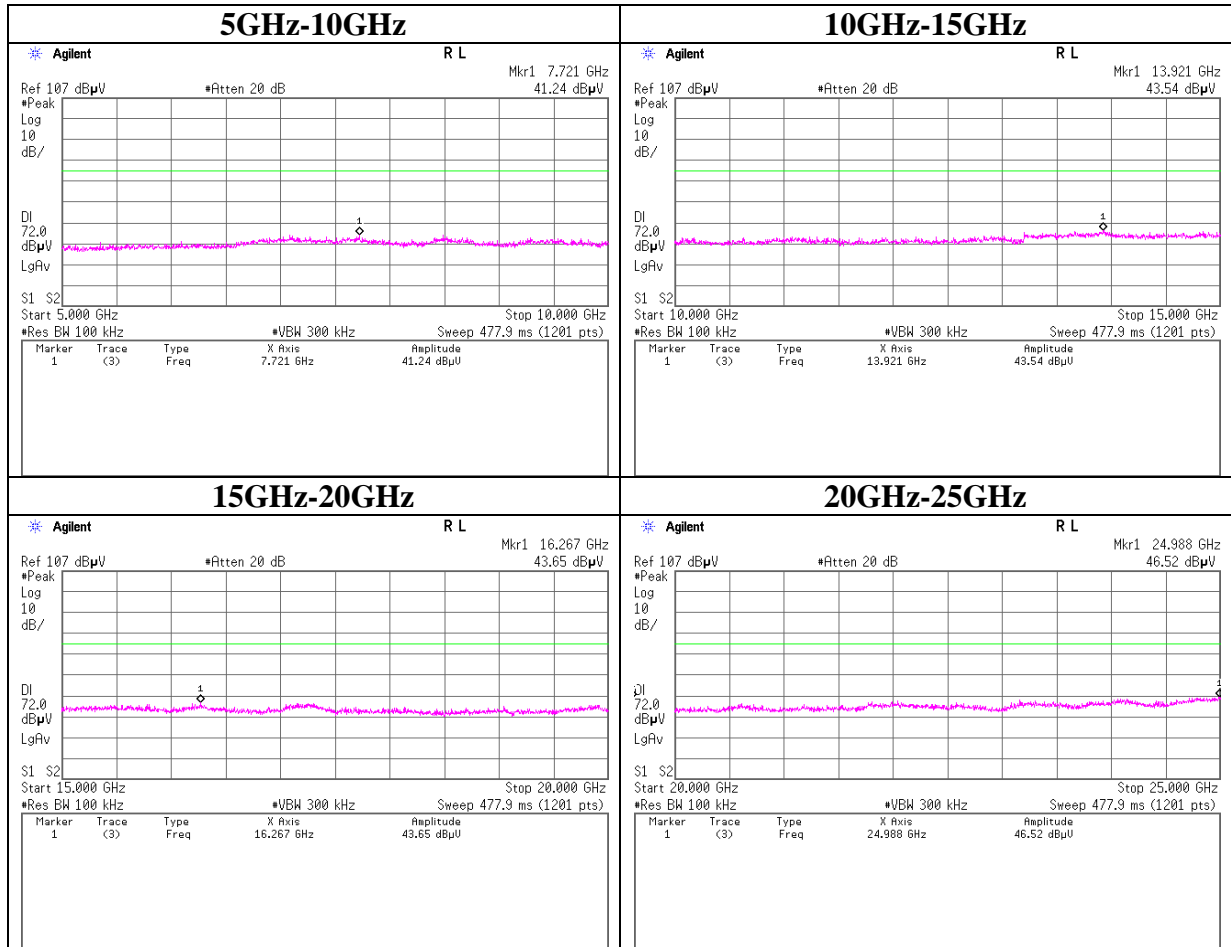
Conducted Spurious Emission

Tx 3DH5 2402MHz



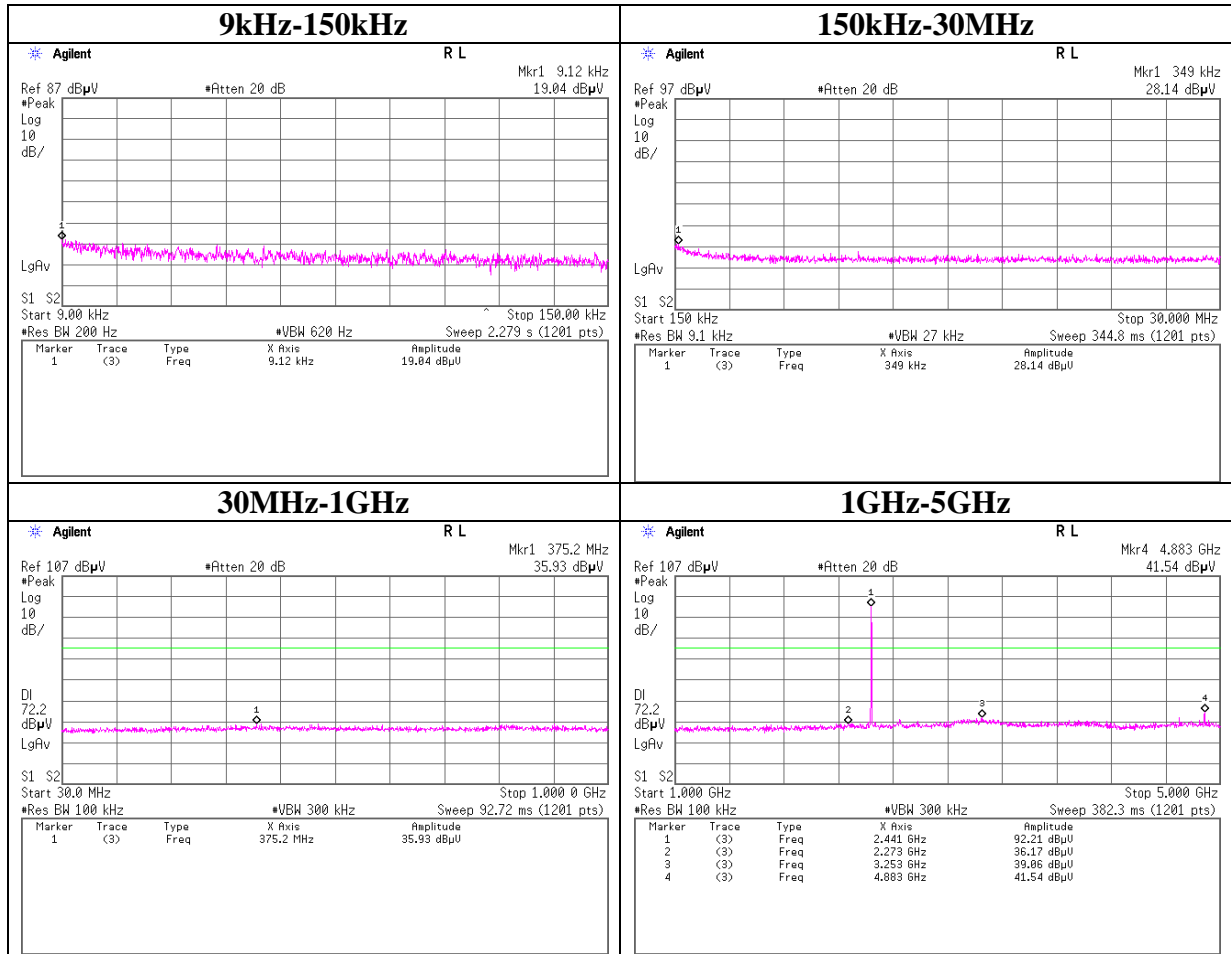
Conducted Spurious Emission

Tx 3DH5 2402MHz



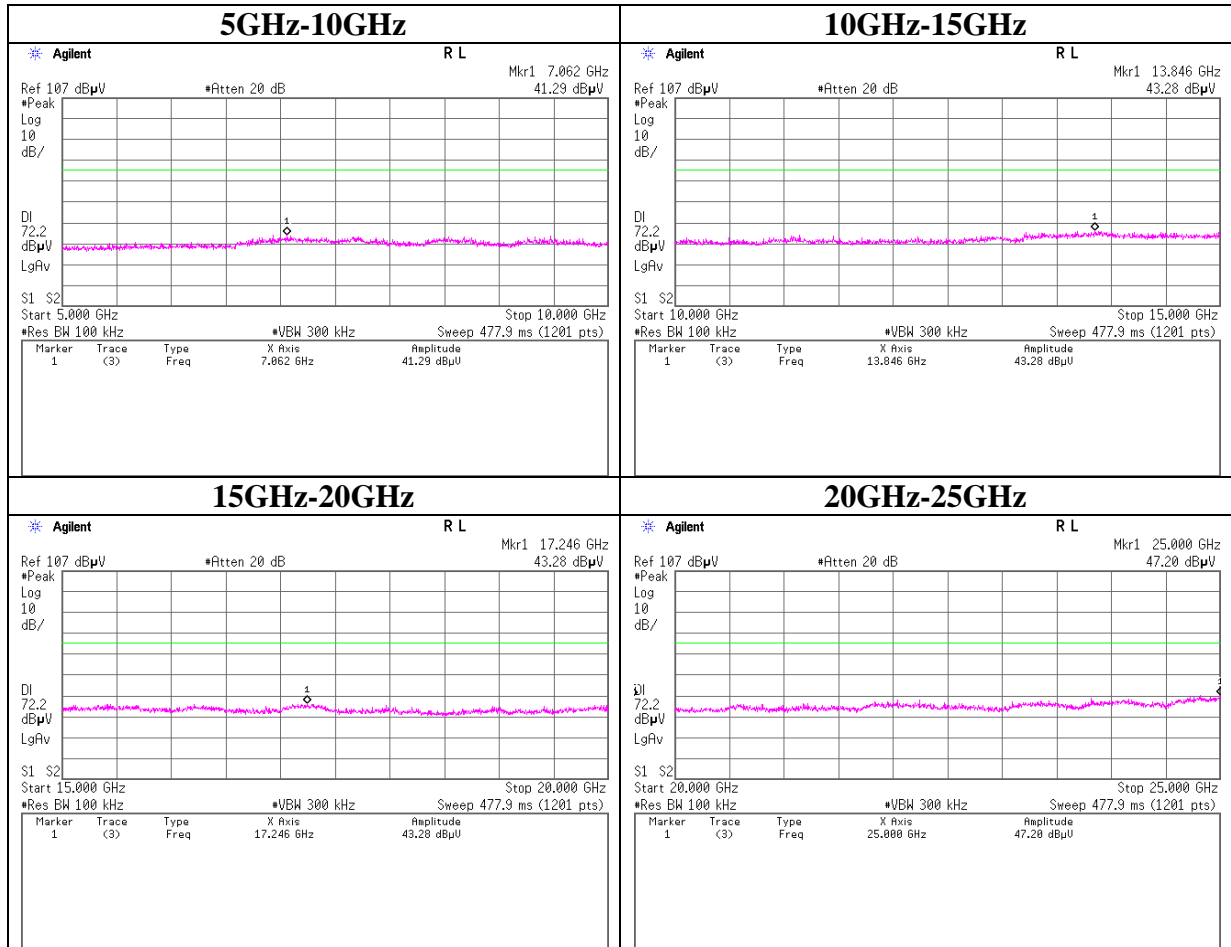
Conducted Spurious Emission

Tx 3DH5 2441MHz



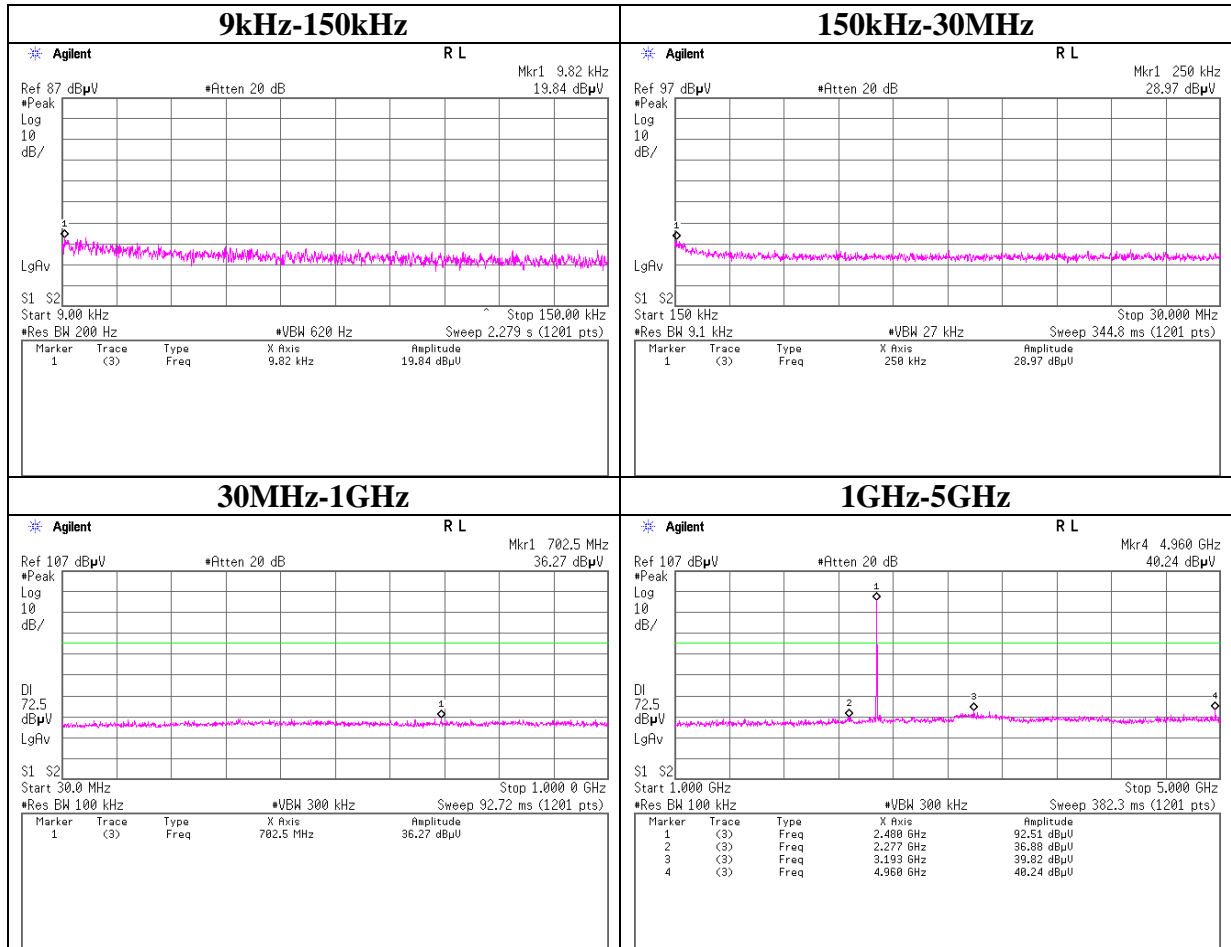
Conducted Spurious Emission

Tx 3DH5 2441MHz



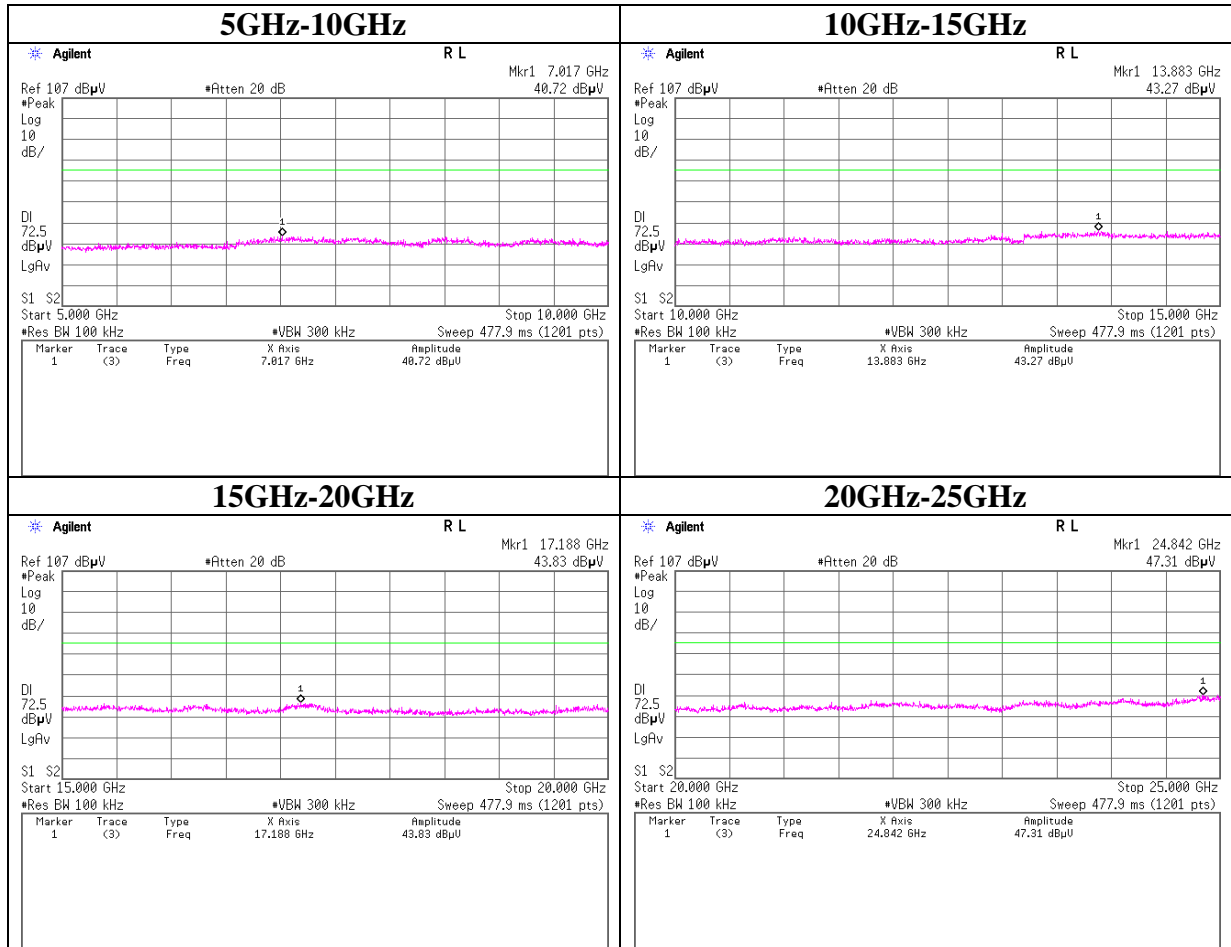
Conducted Spurious Emission

Tx 3DH5 2480MHz



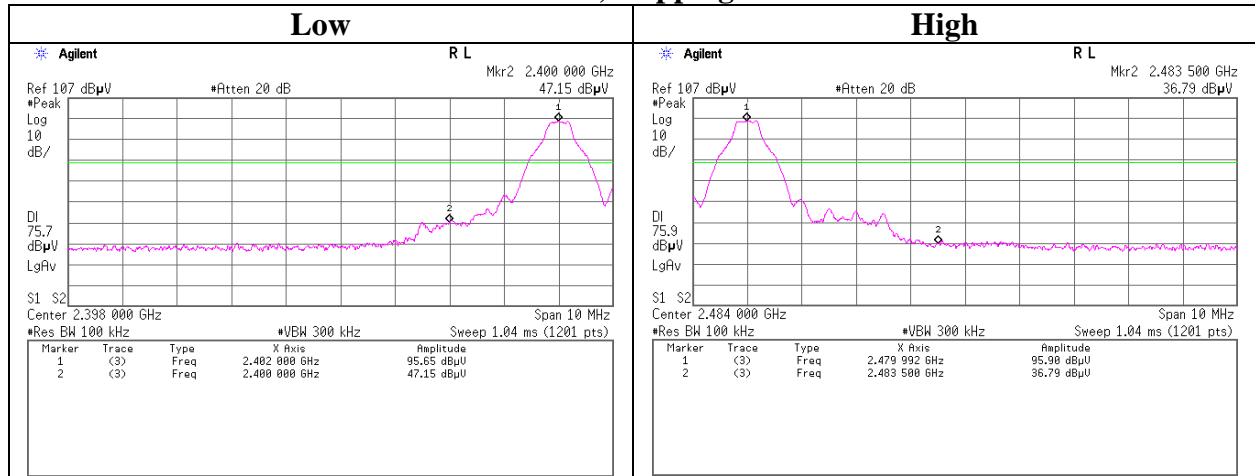
Conducted Spurious Emission

Tx 3DH5 2480MHz

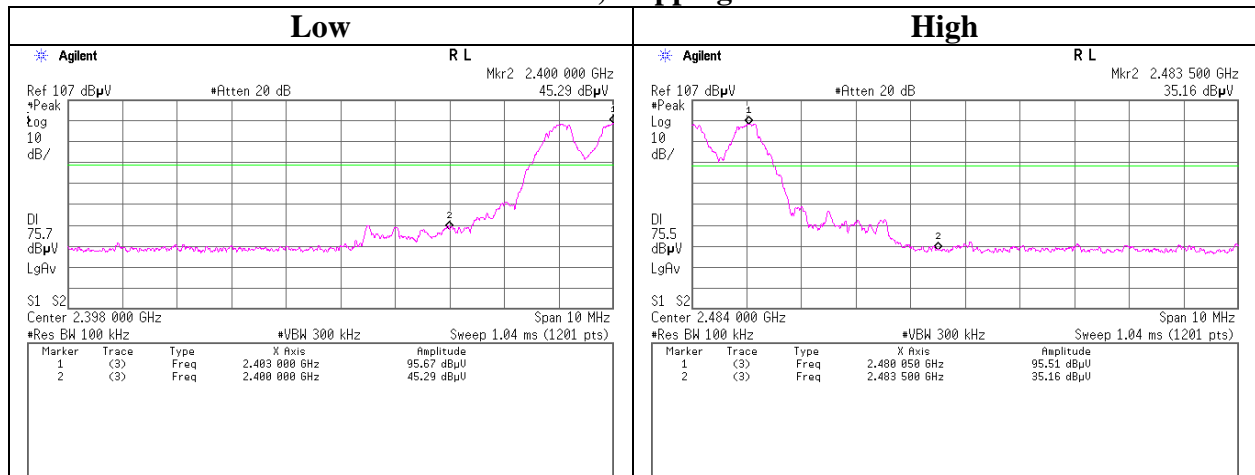


Conducted Emission Band Edge compliance

Tx DH5, Hopping on

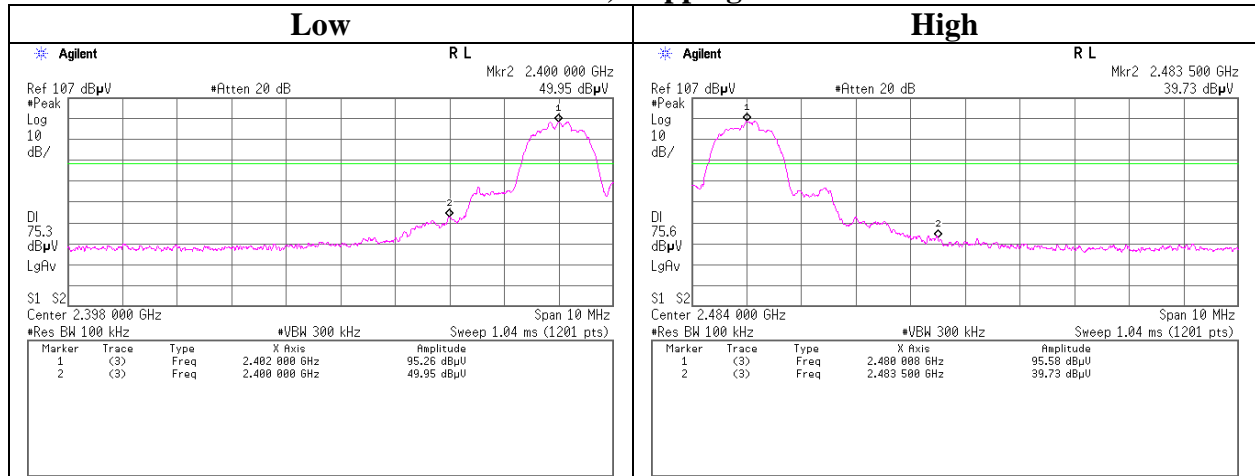


Tx DH5, Hopping off

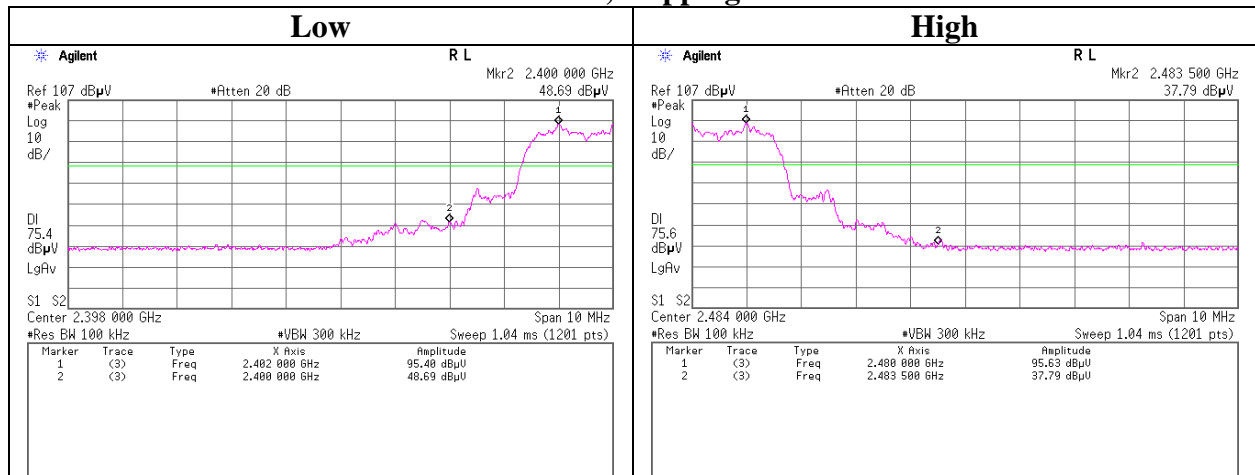


Conducted Emission Band Edge compliance

Tx 3DH5, Hopping on



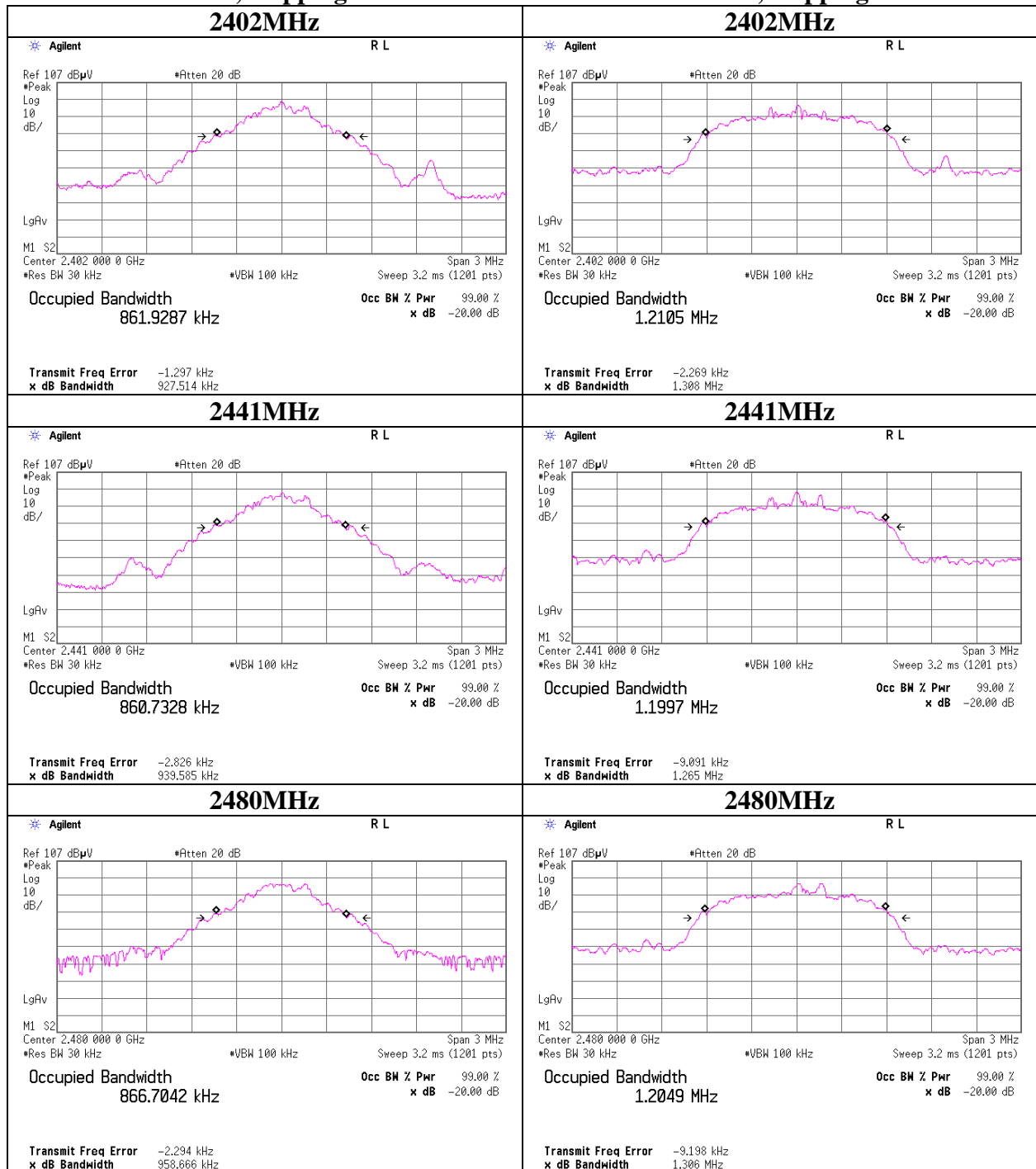
Tx 3DH5, Hopping off



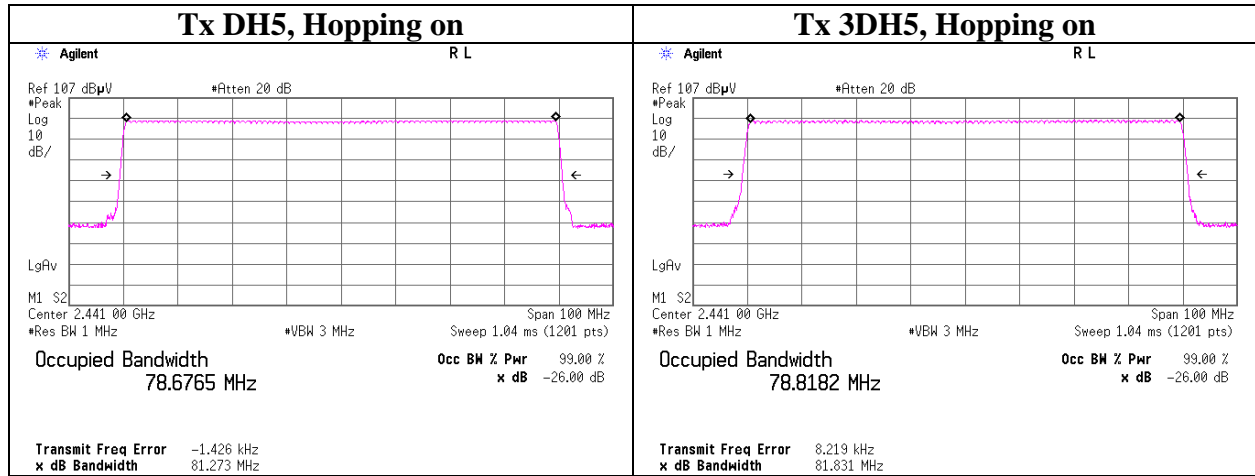
99% Occupied Bandwidth

Tx DH5, Hopping off

Tx 3DH5, Hopping off



99% Occupied Bandwidth



APPENDIX 2: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	CE	2012/06/29 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	CE	2012/02/06 * 12
MJM-14	Measure	KOMELON	KMC-36	-	CE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	CE	-
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	CE	2012/04/06 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	CE	2012/04/03 * 12
MLS-06	LISN(AMN)	Schwarzbeck	NSLK8127	8127363	CE(EUT)	2012/02/06 * 12
MCC-13	Coaxial Cable	Fujikura	3D-2W(12m)/5D-2W(5m)/5D-2W(0.8m)/5D-2W(1m)	-	CE	2012/02/16 * 12
MAT-65	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2012/01/28 * 12
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2012/02/24 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	-	RE	2012/02/06 * 12
MJM-06	Measure	PROMART	SEN1955	-	RE	
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MRENT-95	Spectrum Analyzer	Agilent	E4440A	MY46185823	RE	2012/06/19 * 12
MHA-20	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	RE	2012/05/25 * 12
MCC-133	Microwave Cable	HUBER+SUHNER	SUCOFLEX104	336164/4(1m) / 340640(5m)	RE	2011/09/07 * 12
MPA-11	MicroWave System Amplifier	Agilent	83017A	MY39500779	RE	2012/03/29 * 12
MHA-16	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170306	RE	2012/05/21 * 12
MCC-76	Microwave Cable 1G-26.5GHz	Suhner	SUCOFLEX104	278967/4	RE	2011/12/08 * 12
MHF-19	High Pass Filter 3.5-18.0GHz	TOKIMEC	TF323DCA	602	RE	2011/09/07 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE	2012/08/23 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2011/10/15 * 12
MLA-03	Logperiodic Antenna	Schwarzbeck	USLP9143	174	RE	2011/10/15 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2012/07/12 * 12
MAT-09	Attenuator(6dB)	Weinschel Corp	2	BK7973	RE	2011/11/02 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2012/03/16 * 12
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	AT	2011/11/23 * 12
MPM-12	Power Meter	Anritsu	ML2495A	0825002	AT	2012/06/01 * 12
MPSE-17	Power sensor	Anritsu	MA2411B	0738285	AT	2012/06/01 * 12
MAT-24	Attenuator(10dB)(above 1GHz)	Agilent	8493C	71389	AT	2012/06/27 * 12
MCC-66	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	28636/2	AT	2012/04/25 * 12
MOS-04	Digital Humidity Indicator	N.T	NT-1800	MOS04	AT	2012/02/06 * 12

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

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

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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