



RADIO TEST REPORT

Test Report No. : 11006397H-A

Applicant : **DENSO CORPORATION**
Type of Equipment : **Navigation ECU**
Model No. : **DNNS082-02**
FCC ID : **HYQDNNS082-02**
Test regulation : **FCC Part 15 Subpart C: 2015**
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.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)

Date of test: October 27 to November 4, 2015

Representative test engineer:

Ken Fujita
Ken Fujita
Engineer
Consumer Technology Division

Approved by:

Takayuki Shimada
Takayuki Shimada
Engineer
Consumer Technology Division



NVLAP LAB CODE: 200572-0

This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.
*As for the range of Accreditation in NVLAP, you may refer to the WEB address,
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REVISION HISTORY

Original Test Report No.: 1100639H-A

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SECTION 1: Customer information

Company Name	:	DENSO CORPORATION
Address	:	1-1 Showa-cho, Kariya-shi, Aichi-ken, Japan
Telephone Number	:	+81-566-20-3923
Facsimile Number	:	+81-566-25-4920
Contact Person	:	MINORU SHIBATA

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

2.1 Identification of E.U.T.

Type of Equipment	:	Navigation ECU
Model No.	:	DNNS082-02
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 12 V
Receipt Date of Sample	:	October 27, 2015
Country of Mass-production	:	Japan
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

Model: DNNS082-02 (referred to as the EUT in this report) is a Navigation ECU.

General Specification

Clock frequency(ies) in the system	:	533 MHz, 26MHz, FM LO 1st 2816 MHz to 3462.4 MHz
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Radio Specification

[Bluetooth (Ver. 3.0 with EDR function)]

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480 MHz
Modulation	:	FHSS
Power Supply (radio part input)	:	DC 3.3 V
Antenna type	:	METAL PLATE Antenna
Antenna Gain	:	-3.4 dBi (max)

[GPS part]

Radio Type	:	Receiver
Frequency of Operation	:	1575.42 MHz

[FM part]

Radio Type	:	Receiver
Frequency of Operation	:	87.7 MHz - 107.9 MHz

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2015, final revised on September 8, 2015

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

3.2 Procedures and results

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.4-2009 7. AC powerline conducted emission measurements IC: RSS-Gen 8.8	FCC: Section 15.207 IC: RSS-Gen 8.8	N/A *1)	Complied	-
Carrier Frequency Separation	FCC: FCC Public Notice DA 00-705 IC: -	FCC: Section15.247(a)(1) IC: RSS-247 5.1 (2)	See data.	Complied	Conducted
20dB Bandwidth	FCC: FCC Public Notice DA 00-705 IC: -	FCC: Section15.247(a)(1) IC: RSS-247 5.1 (1)		Complied	Conducted
Number of Hopping Frequency	FCC: FCC Public Notice DA 00-705 IC: -	FCC: Section15.247(a)(1)(iii) IC: RSS-247 5.1 (4)		Complied	Conducted
Dwell time	FCC: FCC Public Notice DA 00-705 IC: -	FCC: Section15.247(a)(1)(iii) IC: RSS-247 5.1 (4)		Complied	Conducted
Maximum Peak Output Power	FCC: FCC Public Notice DA 00-705 IC: RSS-Gen 6.12	FCC: Section15.247(a)(b)(1) IC: RSS-247 5.4 (2)		Complied	Conducted
Spurious Emission & Band Edge Compliance	FCC: FCC Public Notice DA 00-705 IC: RSS-Gen 6.13	FCC: Section15.247(d) IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	1.5 dB 224.999 MHz, QP, Hori.	Complied	Conducted/ Radiated

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

*1) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line.

* In case any questions arise about test procedure, ANSI C63.4: 2009 is also referred.

FCC Part 15.31 (e)

The EUT provides stable voltage (DC 3.3 V) constantly to the wireless transmitter regardless of input voltage. Instead of a new battery, DC power supply was used for the test. That does not affect the test result, therefore the EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203.

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	IC: RSS-Gen 6.6	IC: -	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 $k = 2$.
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Test site (semi anechoic chamber)	Radiated emission Uncertainty (+/-)						
	Measurement distance: 3 m				1 m		0.5 m
	9 kHz - 30 MHz	30 MHz - 300 MHz	300 MHz - 1 GHz	1 GHz - 10 GHz	10 GHz - 18 GHz	18 GHz - 26.5 GHz	26.5 GHz - 40 GHz
No. 1	4.3 dB	5.1 dB	6.2 dB	5.5 dB	5.8 dB	5.8 dB	4.3 dB
No. 2	4.2 dB	5.1 dB	6.2 dB	5.4 dB	5.7 dB	5.9 dB	5.6 dB
No. 3	4.4 dB	5.1 dB	6.3 dB	5.2 dB	5.5 dB	5.8 dB	5.5 dB
No. 4	4.7 dB	5.3 dB	6.3 dB	5.3 dB	5.7 dB	5.9 dB	5.5 dB

Antenna terminal test Uncertainty (+/-)							
Power meter		Conducted emission and Power density			Conducted emission		Channel power
Below 1 GHz	Above 1 GHz	Below 1 GHz	1 GHz - 3 GHz	3 GHz - 18 GHz	18 GHz - 26.5 GHz	26.5 GHz - 40 GHz	
0.9 dB	1.0 dB	1.4 dB	1.7 dB	2.8 dB	2.8 dB	2.9 dB	

Radiated emission test

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

3.5 Test Location

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Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	2973C-1	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	2973C-2	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	2973C-3	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	2973C-4	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	-	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.6 shielded room	-	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	-	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	-	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	-	3.1 x 5.0 x 2.7	N/A	-	-
No.9 measurement room	-	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.11 measurement room	-	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

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

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

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

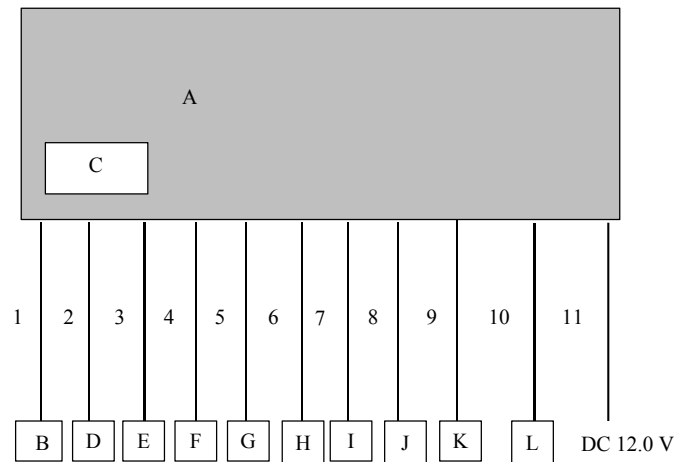
4.1 Operating Mode(s)

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

Details of Operating Mode(s)

Test Item	Mode	Tested frequency
Spurious Emission (Conducted/Radiated)	Tx (Hopping Off) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Carrier Frequency Separation	Tx (Hopping On) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
20dB Bandwidth	Tx (Hopping Off) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
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, 2DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Band Edge Compliance (Conducted)	Tx DH5, 3DH5 -Hopping On -Hopping Off	2402 MHz 2480 MHz
99% Occupied Bandwidth	Tx DH5, 3DH5 -Hopping On -Hopping Off	2402 MHz 2441 MHz 2480 MHz
*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) *2DH mode (2Mb/s EDR: pi/4DQPSK) was excluded for other tests than power measurement by using 3DH mode (3 Mb/s EDR: 8DPSK) as a representative. * It is considered that the non-tested packet type (e.g. inquiry) can be omitted as it is complied with above all test items based on Bluetooth Core specification. *EUT has the power settings by the software as follows; Power settings: BDR: Ext/Int : 0/57 EDR: Ext/Int : 0/55 Software: CSR Blue Test 3 *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.		

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	Navigation ECU	DNNS082-02	001	DENSO CORPORATION	EUT
B	FM Antenna	-	-	-	-
C	Micro SD	-	-	-	-
D	USB Memory	-	E3A0000992E4	I·O DATA	-
E	GPS Antenna	-	06080005	-	-
F	Extension Box	GEX-0128	NEGE077316US	PIONEER Corporation	-
G	DCM	88650-47510	-	DENSO CORPORATION	-
H	Dummy Load	-	-	-	-
I	Camera	GP-K-D33-D15R	58B00651	-	-
J	Steering SW	-	-	-	-
K	Microphone	-	-	-	-
L	Switch	-	-	-	-
M	iPod	A1367	CCQG50WDDCPC	Apple	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Antenna Cable	4.6	Shielded	Shielded	-
2	USB Cable	2.7	Shielded	Shielded	-
3	Antenna Cable	6.3	Shielded	Shielded	-
4	Signal Cable	2.0	Shielded	Shielded	-
5	Signal Cable	2.9	Unshielded	Unshielded	-
6	Signal Cable	3.2	Unshielded	Unshielded	-
7	Signal Cable	3.2	Unshielded	Unshielded	-
8	Signal Cable	3.2	Unshielded	Unshielded	-
9	Signal Cable	9.2	Unshielded	Unshielded	-
10	Signal Cable	9.2	Unshielded	Unshielded	-
11	DC Cable	7.0	Unshielded	Unshielded	-

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SECTION 5: Radiated Spurious Emission

Test Procedure

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m 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 m and 4 m 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	30 MHz to 300 MHz	300 MHz to 1 GHz	Above 1 GHz
Antenna Type	Biconical	Logperiodic	Horn

In any 100 kHz 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 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9 (IC) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (IC).

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

*1) Although DA 00-705 accepts VBW = 10 Hz 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 customer's Standard Position and Vertical Position as tilt angle check.

As a result, the test was performed with the worst one.

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

Measurement range	: 30 M - 26.5 GHz
Test data	: APPENDIX
Test result	: Pass

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SECTION 6: 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	3 MHz	30 kHz	100 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak Average *3)	-	Power Meter (Sensor: 50MHz BW)
Carrier Frequency Separation	3 MHz	30 kHz	100 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Number of Hopping Frequency	30 MHz	300 kHz	1 MHz	Auto	Peak	Max Hold	Spectrum Analyzer
Dwell Time	Zero Span	100 kHz, 1 MHz	300 kHz, 3 MHz	As necessary capture the entire dwell time per hopping channel	Peak	Clear Write	Spectrum Analyzer
Conducted Spurious Emission *2)	9 kHz to 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz to 30 MHz	9.1 kHz	27 kHz				
	30 MHz to 25 GHz	100 kHz	300 kHz				
Conducted Spurious Emission Band Edge compliance	10 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer

*1) Peak hold was applied as Worst-case measurement.

*2) 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 low enough as shown in the chart.

(9 kHz - 150 kHz: RBW = 200Hz, 150 kHz - 30 MHz: RBW = 9.1 kHz).

*3) Reference data

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

Test data : APPENDIX

Test result : Pass

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APPENDIX 1: Test data

20dB Bandwidth and Carrier Frequency Separation

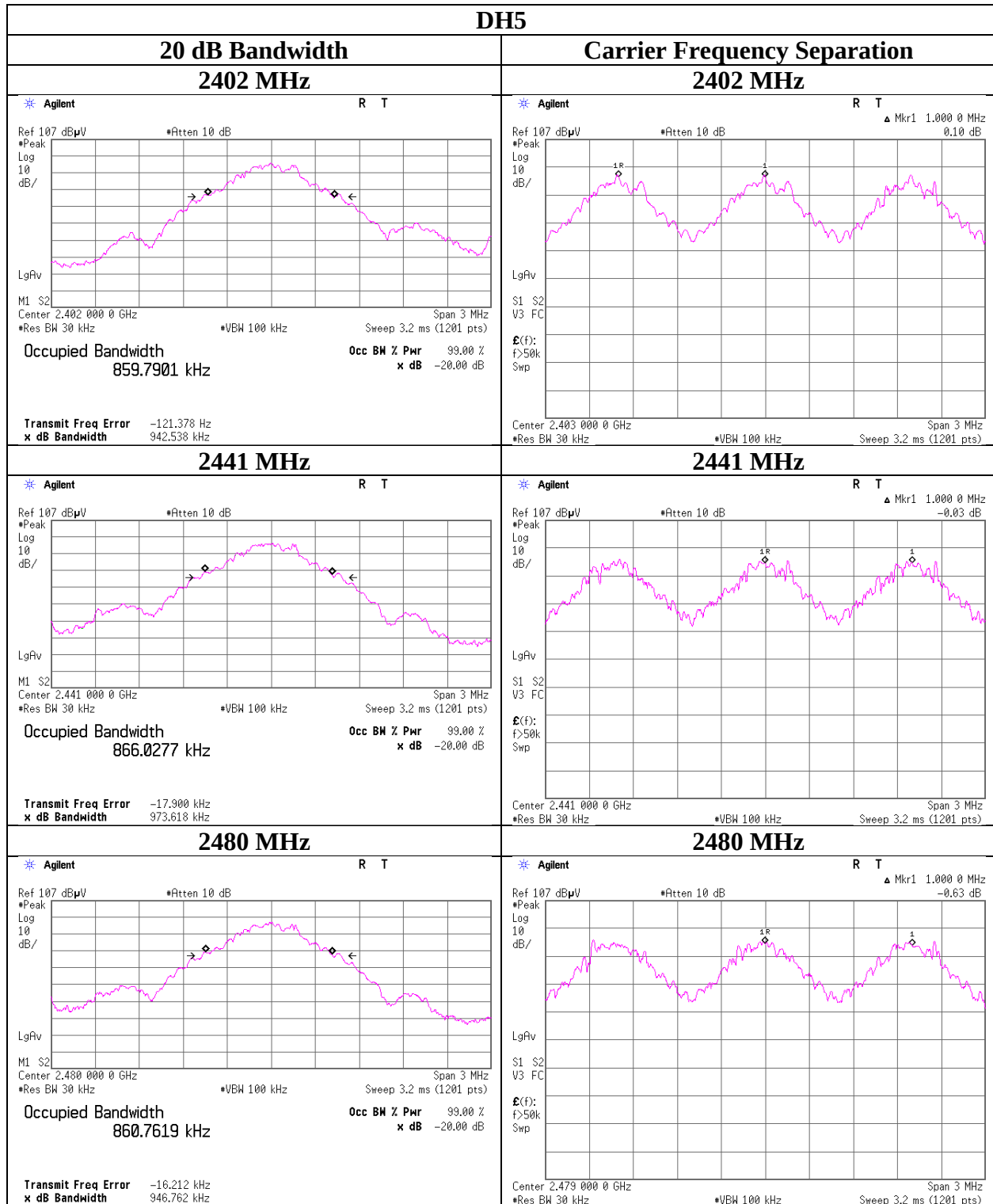
Test place Ise EMC Lab. No.11 Measurement Room
Report No. 11006397H
Date October 27, 2015
Temperature / Humidity 23 deg. C / 57 % RH
Engineer Ken Fujita
Mode Tx, Hopping Off

Mode	Freq. [MHz]	20dB Bandwidth [MHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	0.943	1.000	≥ 0.628
DH5	2441.0	0.974	1.000	≥ 0.649
DH5	2480.0	0.947	1.000	≥ 0.631
3DH5	2402.0	1.276	1.000	≥ 0.851
3DH5	2441.0	1.262	1.000	≥ 0.841
3DH5	2480.0	1.288	1.000	≥ 0.859

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

No limit applies to 20dB Bandwidth.

20dB Bandwidth and Carrier Frequency Separation



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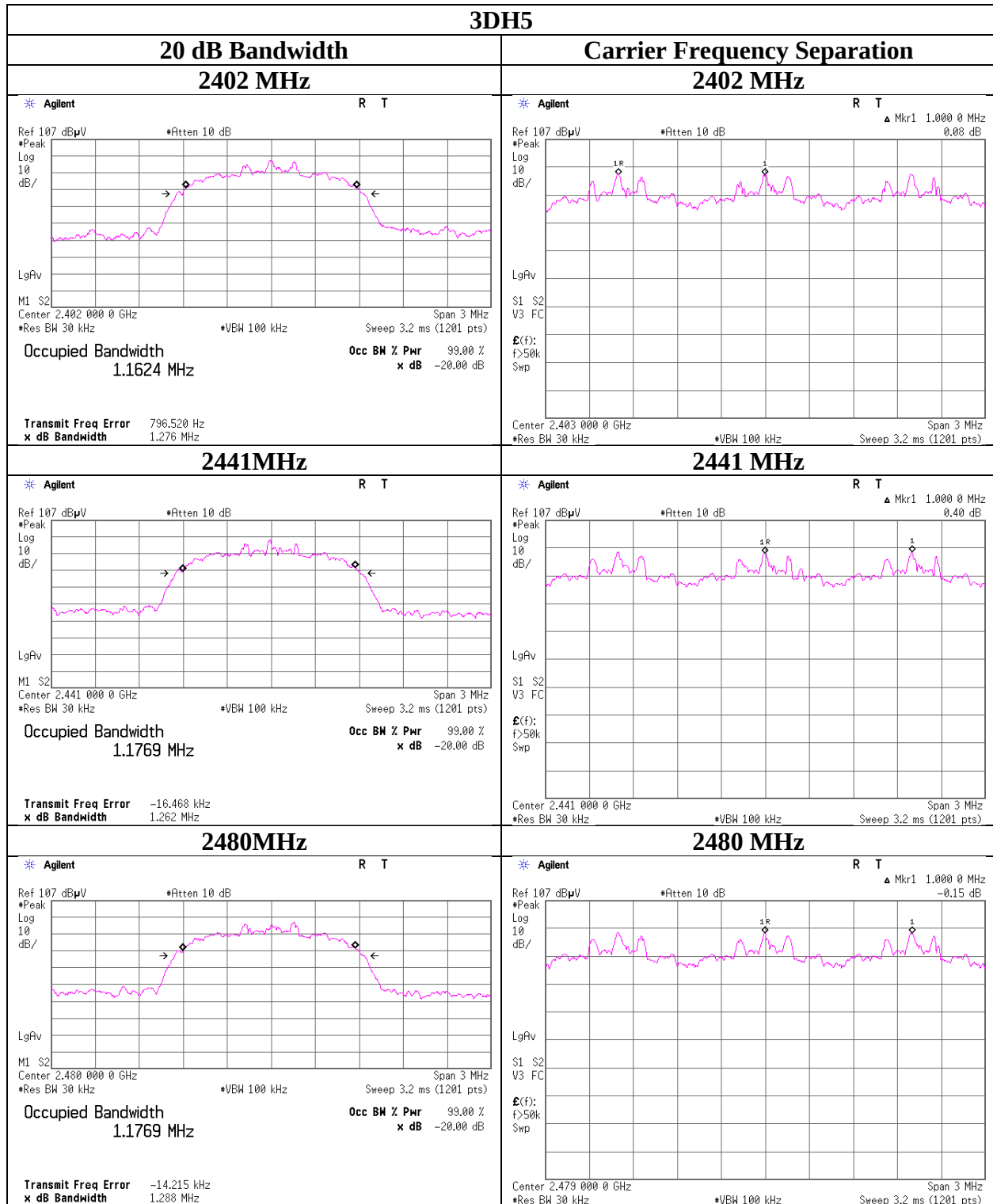
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20dB Bandwidth and Carrier Frequency Separation



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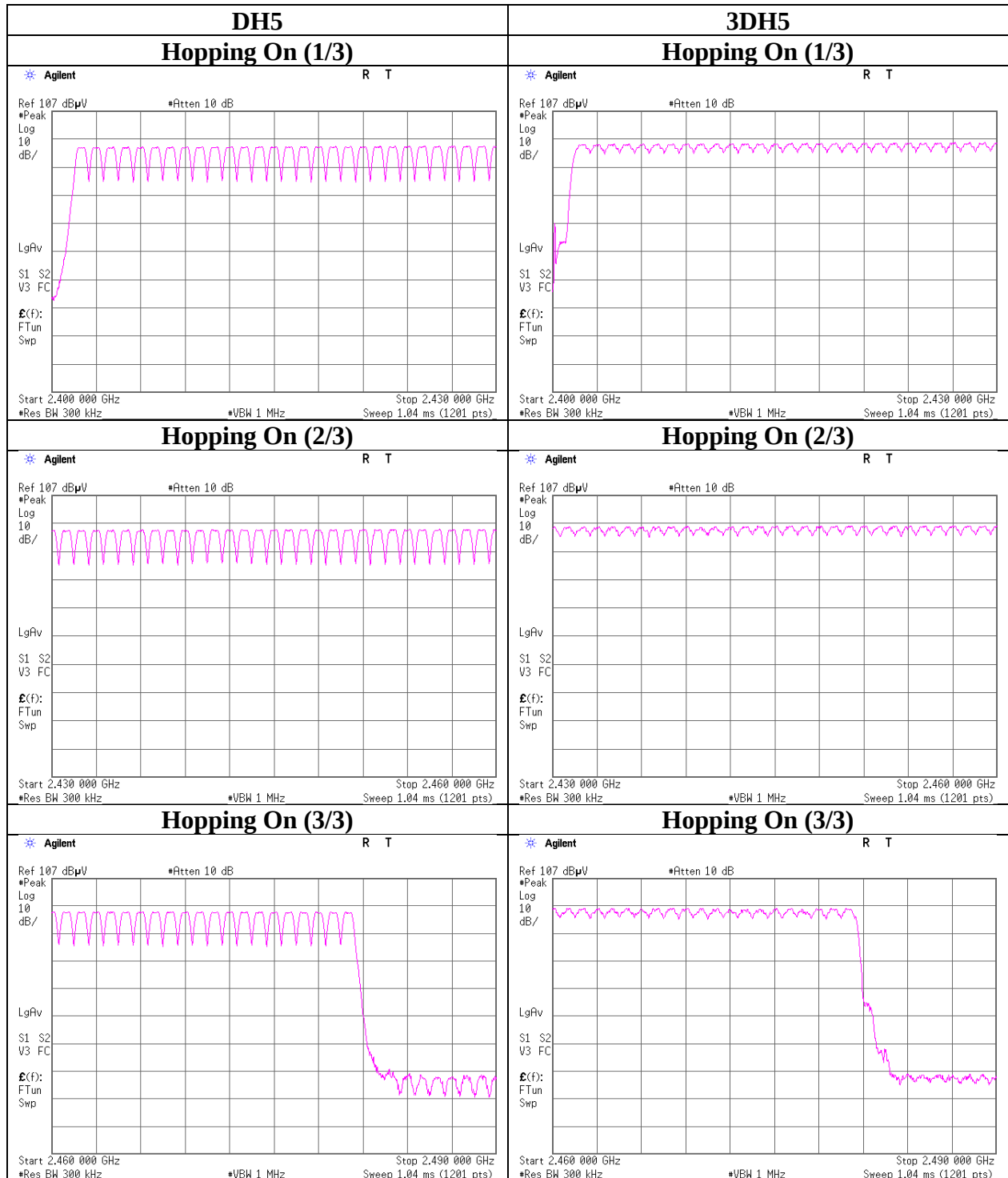
Number of Hopping Frequency

Test place Ise EMC Lab. No.11 Measurement Room
Report No. 11006397H
Date October 27, 2015
Temperature / Humidity 23 deg. C / 57 % RH
Engineer Ken Fujita
Mode Tx, Hopping On

Mode	Number of channel [channels]	Limit [channels]
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



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Dwell time

Test place : Ise EMC Lab. No.11 Measurement Room
Report No. : 11006397H
Date : October 27, 2015
Temperature / Humidity : 23 deg. C / 57 % RH
Engineer : Ken Fujita
Mode : Tx, Hopping On

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 [msec]	Result [msec]	Limit [msec]
DH1	50.8 times / 5 sec. x 31.6 sec. = 322 times	0.434	140	400
DH3	25.8 times / 5 sec. x 31.6 sec. = 164 times	1.693	278	400
DH5	16.8 times / 5 sec. x 31.6 sec. = 107 times	2.956	316	400
3DH1	50.6 times / 5 sec. x 31.6 sec. = 320 times	0.449	144	400
3DH3	25.6 times / 5 sec. x 31.6 sec. = 162 times	1.705	276	400
3DH5	16.8 times / 5 sec. x 31.6 sec. = 107 times	2.968	318	400

Sample Calculation

Result = Number of transmission x Length of transmission

*Average data of 5 tests.(except Inquiry)

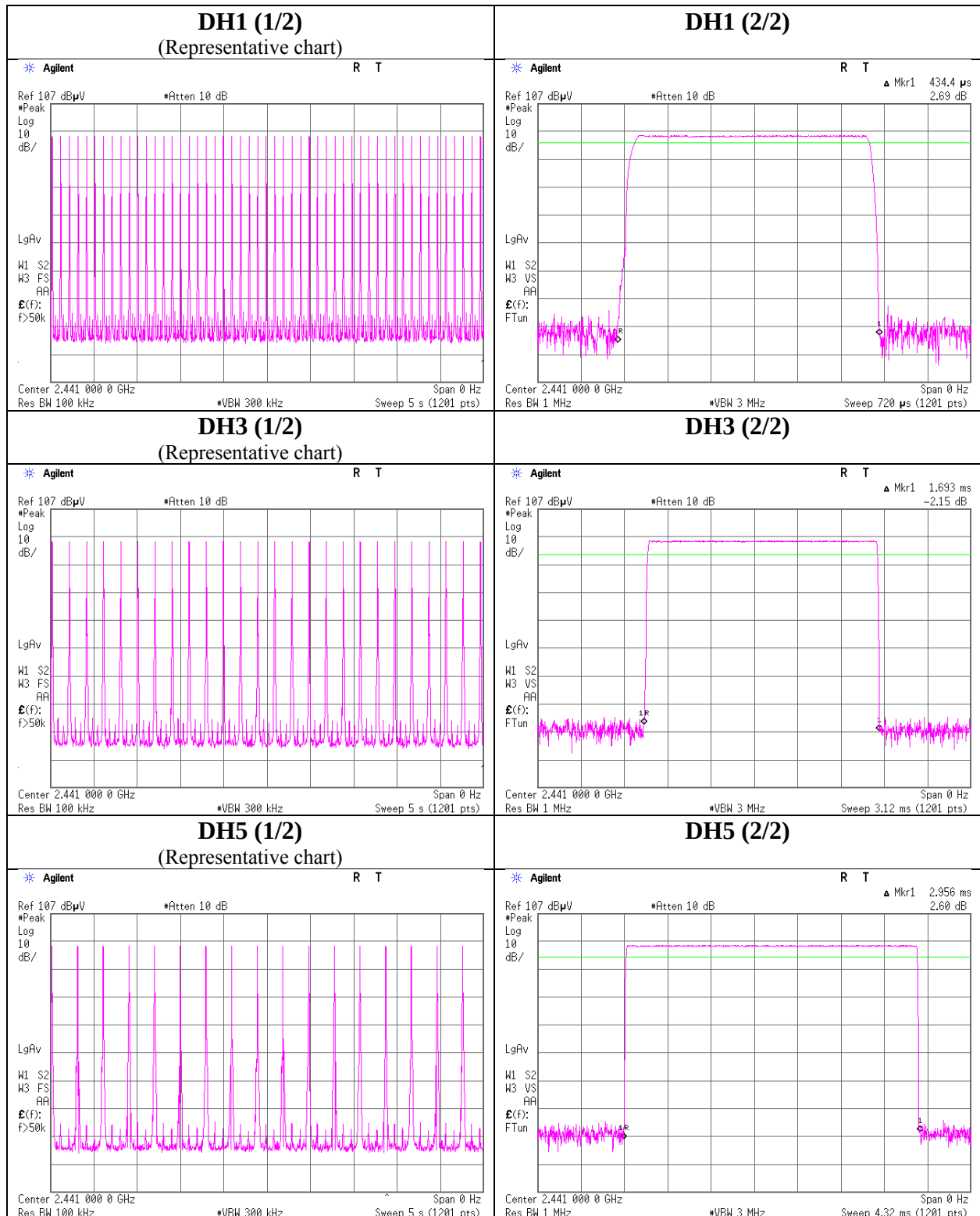
Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	51	51	51	50	51	50.8
DH3	25	26	26	26	26	25.8
DH5	17	17	16	17	17	16.8
3DH1	51	50	51	50	51	50.6
3DH3	25	26	25	26	26	25.6
3DH5	17	17	17	16	17	16.8

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

Dwell time



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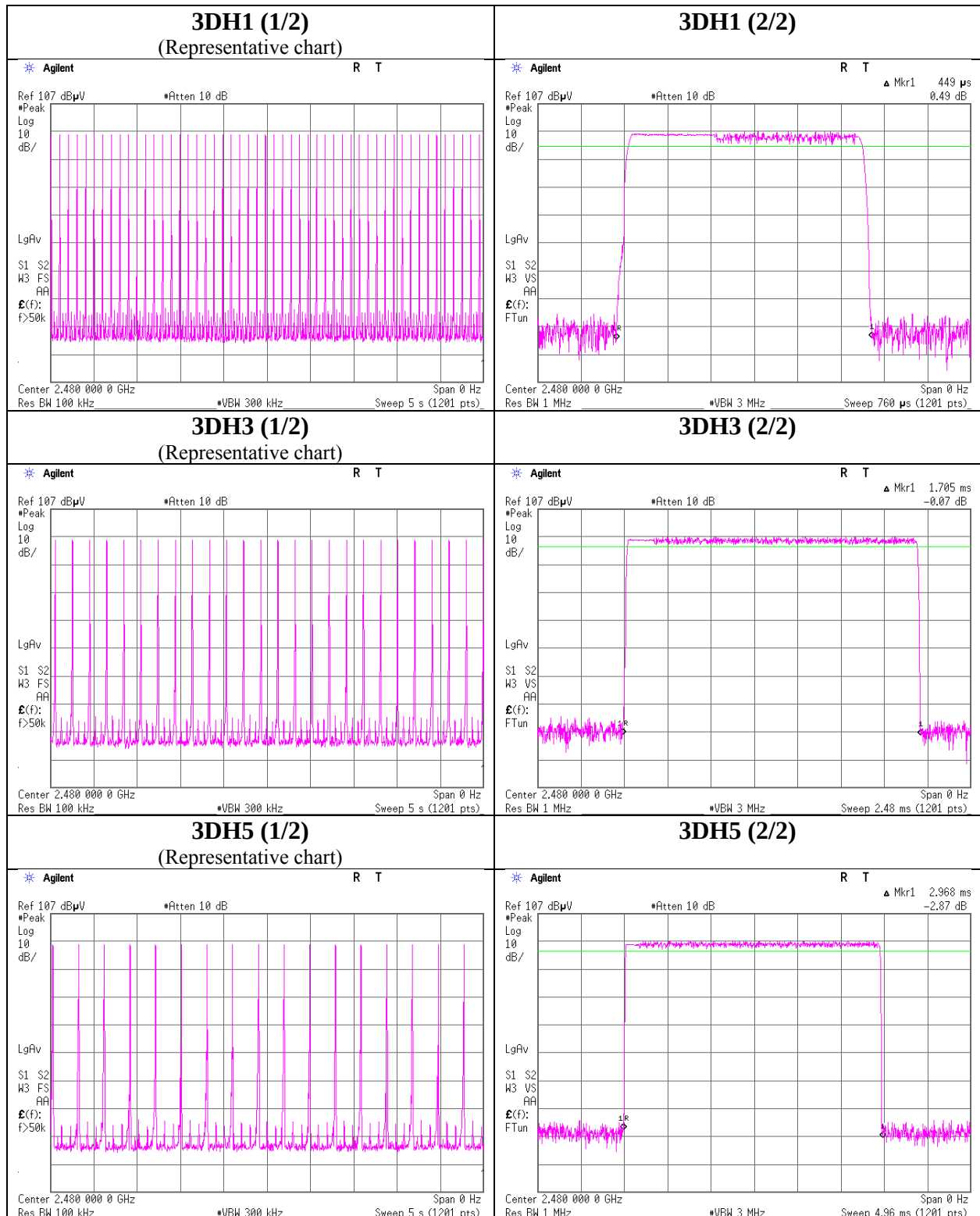
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Dwell time



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Maximum Peak Output Power

Test place : Ise EMC Lab. No.11 Measurement Room
Report No. : 11006397H
Date : October 27, 2015
Temperature / Humidity : 23 deg. C / 43 % RH
Engineer : Ken Fujita
Mode : Tx, Hopping Off

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
					[dBm]	[mW]	[dBm]	[mW]	
DH5	2402.0	-11.77	1.92	10.00	0.15	1.04	20.96	125	20.81
DH5	2441.0	-11.20	1.93	10.00	0.73	1.18	20.96	125	20.23
DH5	2480.0	-11.23	1.95	10.00	0.72	1.18	20.96	125	20.24
2DH5	2402.0	-10.44	1.92	10.00	1.48	1.41	20.96	125	19.48
2DH5	2441.0	-9.69	1.93	10.00	2.24	1.67	20.96	125	18.72
2DH5	2480.0	-9.70	1.95	10.00	2.25	1.68	20.96	125	18.71
3DH5	2402.0	-10.19	1.92	10.00	1.73	1.49	20.96	125	19.23
3DH5	2441.0	-9.34	1.93	10.00	2.59	1.82	20.96	125	18.37
3DH5	2480.0	-9.23	1.95	10.00	2.72	1.87	20.96	125	18.24

Sample Calculation:

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

*The equipment and cables were not used for factor 0 dB of the data sheets.

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.

Average Output Power
(Reference data for RF Exposure)

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11006397H
Date	October 27, 2015
Temperature / Humidity	23 deg. C / 43 % RH
Engineer	Ken Fujita
Mode	Tx, Hopping Off

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)	
					[dBm]	[mW]
DH5	2402.0	-13.47	1.92	10.00	-1.55	0.70
DH5	2441.0	-12.76	1.93	10.00	-0.83	0.83
DH5	2480.0	-12.78	1.95	10.00	-0.83	0.83
2DH5	2402.0	-14.12	1.92	10.00	-2.20	0.60
2DH5	2441.0	-13.25	1.93	10.00	-1.32	0.74
2DH5	2480.0	-13.24	1.95	10.00	-1.29	0.74
3DH5	2402.0	-14.13	1.92	10.00	-2.21	0.60
3DH5	2441.0	-13.25	1.93	10.00	-1.32	0.74
3DH5	2480.0	-13.39	1.95	10.00	-1.44	0.72

Sample Calculation:

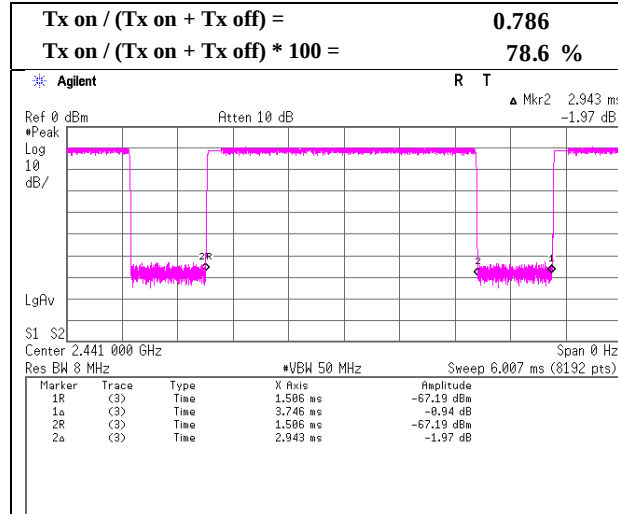
Result (Frame power) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

*The equipment and cables were not used for factor 0 dB of the data sheets.

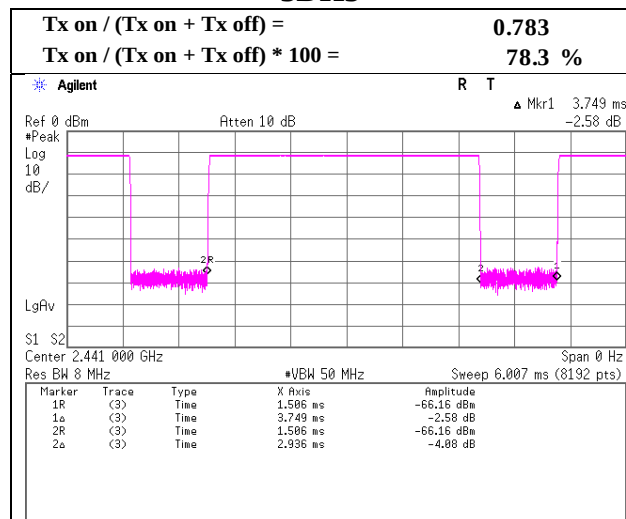
Burst Rate Confirmation

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11006397H
Date	October 27, 2015
Temperature / Humidity	23 deg. C / 57 % RH
Engineer	Ken Fujita
Mode	Tx, Hopping Off

DH5



3DH5



UL Japan, Inc.

Ise EMC Lab.

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Radiated Spurious Emission

Test place : Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No. : 11006397H
Date : October 27, 2015 October 31, 2015
Temperature / Humidity : 23 deg. C / 58 % RH 23 deg. C / 41 % RH
Engineer : Kazuya Yoshioka Kazuya Yoshioka
(Above 1GHz) (Below 1GHz)
Mode : Tx, Hopping Off, DH5 2402 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	160.513	QP	34.9	15.6	8.8	31.9	27.4	43.5	16.1	
Hori	209.904	QP	32.9	16.6	9.2	31.8	26.9	43.5	16.6	
Hori	224.998	QP	49.9	16.8	9.3	31.8	44.2	46.0	1.8	
Hori	370.410	QP	39.8	17.9	10.4	31.9	36.2	46.0	9.8	
Hori	647.998	QP	35.6	21.2	12.0	32.1	36.7	46.0	9.3	
Hori	936.002	QP	32.2	25.4	13.5	31.0	40.1	46.0	5.9	
Hori	1065.907	PK	61.9	24.6	2.3	34.9	53.9	73.9	20.0	
Hori	1332.556	PK	65.2	25.1	2.6	34.0	58.9	73.9	15.0	
Hori	1399.035	PK	61.6	25.2	2.6	33.8	55.6	73.9	18.3	
Hori	2390.000	PK	41.7	27.9	3.3	32.1	40.8	73.9	33.1	
Hori	3145.540	PK	51.5	28.4	3.8	31.8	51.9	73.9	22.0	
Hori	4804.000	PK	43.9	32.8	5.7	31.3	51.1	73.9	22.8	
Hori	7206.000	PK	43.5	36.8	6.9	32.6	54.6	73.9	19.3	
Hori	9608.000	PK	43.8	38.1	7.6	32.6	56.9	73.9	17.0	
Hori	1065.907	AV	39.5	24.6	2.3	34.9	31.5	53.9	22.4	
Hori	1332.556	AV	46.5	25.1	2.6	34.0	40.2	53.9	13.7	
Hori	1399.035	AV	46.5	25.2	2.6	33.8	40.5	53.9	13.4	
Hori	2390.000	AV	29.8	27.9	3.3	32.1	28.9	53.9	25.0	
Hori	3145.540	AV	49.2	28.4	3.8	31.8	49.6	53.9	4.3	
Hori	4804.000	AV	35.0	32.8	5.7	31.3	42.2	53.9	11.7	
Hori	7206.000	AV	30.7	36.8	6.9	32.6	41.8	53.9	12.1	
Hori	9608.000	AV	30.3	38.1	7.6	32.6	43.4	53.9	10.5	
Vert	160.512	QP	38.8	15.6	8.8	31.9	31.3	43.5	12.2	
Vert	209.902	QP	43.5	16.6	9.2	31.8	37.5	43.5	6.0	
Vert	224.998	QP	48.7	16.8	9.3	31.8	43.0	46.0	3.0	
Vert	370.412	QP	36.5	17.9	10.4	31.9	32.9	46.0	13.1	
Vert	648.002	QP	35.3	21.2	12.0	32.1	36.4	46.0	9.6	
Vert	936.000	QP	31.9	25.4	13.5	31.0	39.8	46.0	6.2	
Vert	1066.000	PK	63.0	24.6	2.3	34.9	55.0	73.9	18.9	
Vert	1332.403	PK	63.5	25.1	2.6	34.0	57.2	73.9	16.7	
Vert	1399.155	PK	59.1	25.2	2.6	33.8	53.1	73.9	20.8	
Vert	2390.000	PK	41.4	27.9	3.3	32.1	40.5	73.9	33.4	
Vert	3145.668	PK	49.5	28.4	3.8	31.8	49.9	73.9	24.0	
Vert	4804.000	PK	45.9	32.8	5.7	31.3	53.1	73.9	20.8	
Vert	7206.000	PK	43.3	36.8	6.9	32.6	54.4	73.9	19.5	
Vert	9608.000	PK	43.5	38.1	7.6	32.6	56.6	73.9	17.3	
Vert	1066.000	AV	40.0	24.6	2.3	34.9	32.0	53.9	21.9	
Vert	1332.403	AV	44.6	25.1	2.6	34.0	38.3	53.9	15.6	
Vert	1399.155	AV	36.4	25.2	2.6	33.8	30.4	53.9	23.5	
Vert	2390.000	AV	28.4	27.9	3.3	32.1	27.5	53.9	26.4	
Vert	3145.668	AV	46.7	28.4	3.8	31.8	47.1	53.9	6.8	
Vert	4804.000	AV	36.4	32.8	5.7	31.3	43.6	53.9	10.3	
Vert	7206.000	AV	30.7	36.8	6.9	32.6	41.8	53.9	12.1	
Vert	9608.000	AV	30.3	38.1	7.6	32.6	43.4	53.9	10.5	

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

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

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

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	97.0	28.0	3.3	32.1	96.2	-	-	Carrier
Hori	2400.000	PK	39.6	28.0	3.3	32.1	38.8	76.2	37.4	
Vert	2402.000	PK	93.5	28.0	3.3	32.1	92.7	-	-	Carrier
Vert	2400.000	PK	40.6	28.0	3.3	32.1	39.8	72.7	32.9	

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

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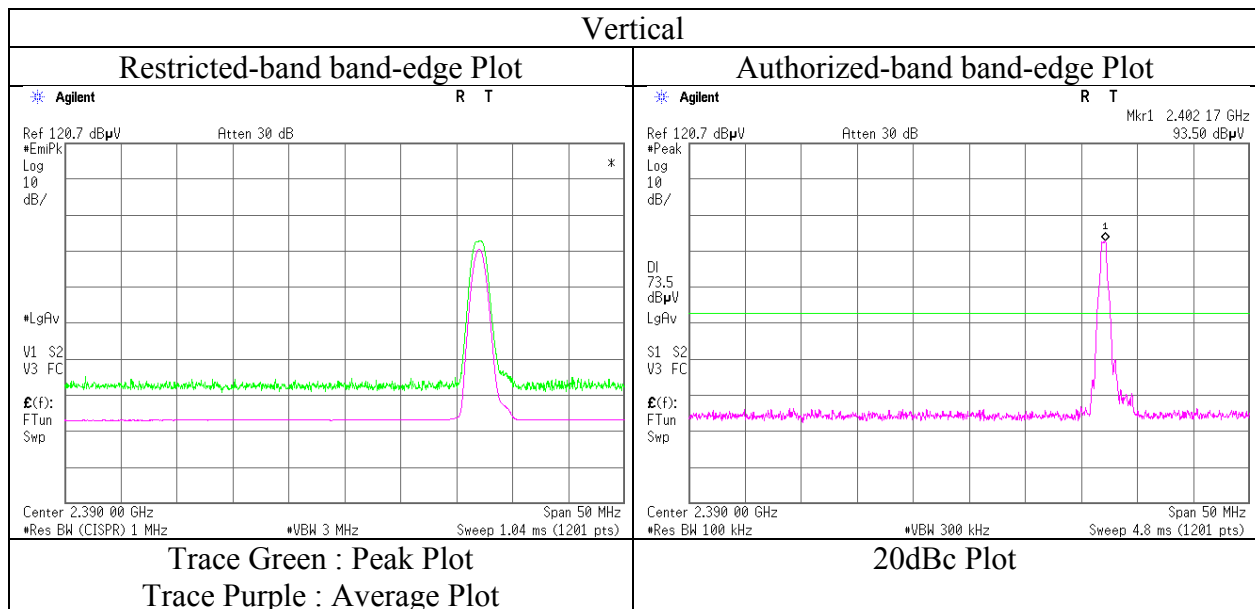
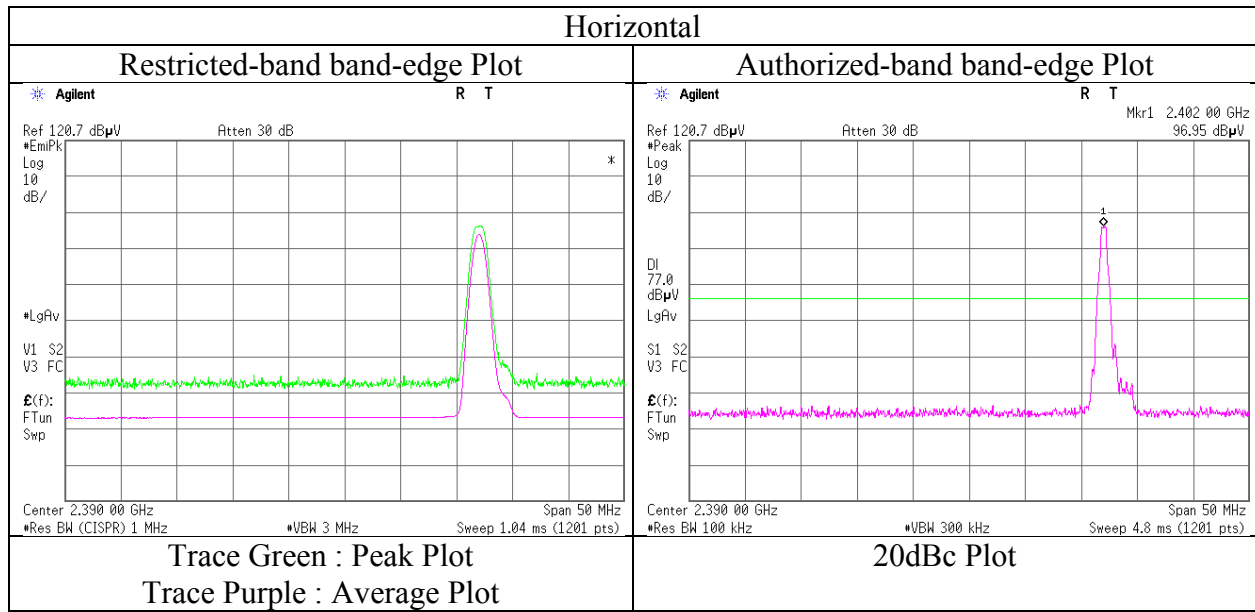
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Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No.	11006397H
Date	October 27, 2015
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Kazuya Yoshioka
Mode	Tx, Hopping Off, DH5 2402 MHz



* Final result of restricted band edge was shown in tabular data.

UL Japan, Inc.

Ise EMC Lab.

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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission

Test place : Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No. : 11006397H
Date : October 27, 2015 October 31, 2015
Temperature / Humidity : 23 deg. C / 58 % RH 23 deg. C / 41 % RH
Engineer : Kazuya Yoshioka Kazuya Yoshioka
(Above 1GHz) (Below 1GHz)
Mode : Tx, Hopping Off, DH5 2441 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	172.859	QP	36.3	15.9	8.9	31.9	29.2	43.5	14.3	
Hori	207.733	QP	32.9	16.6	9.2	31.8	26.9	43.5	16.6	
Hori	224.999	QP	50.2	16.8	9.3	31.8	44.5	46.0	1.5	
Hori	361.331	QP	38.8	17.8	10.3	31.8	35.1	46.0	10.9	
Hori	374.997	QP	38.9	18.0	10.4	31.9	35.4	46.0	10.6	
Hori	936.000	QP	32.1	25.4	13.5	31.0	40.0	46.0	6.0	
Hori	1265.598	PK	64.5	24.9	2.5	34.2	57.7	73.9	16.2	
Hori	1332.485	PK	64.7	25.1	2.6	34.0	58.4	73.9	15.5	
Hori	1399.077	PK	63.8	25.2	2.6	33.8	57.8	73.9	16.1	
Hori	3145.555	PK	51.6	28.4	3.8	31.8	52.0	73.9	21.9	
Hori	4882.000	PK	44.5	33.1	5.8	31.3	52.1	73.9	21.8	
Hori	7323.000	PK	43.7	36.8	6.9	32.6	54.8	73.9	19.1	
Hori	9764.000	PK	43.0	38.2	7.7	32.7	56.2	73.9	17.7	
Hori	1265.598	AV	39.6	24.9	2.5	34.2	32.8	53.9	21.1	
Hori	1332.485	AV	47.0	25.1	2.6	34.0	40.7	53.9	13.2	
Hori	1399.077	AV	39.7	25.2	2.6	33.8	33.7	53.9	20.2	
Hori	3145.555	AV	49.4	28.4	3.8	31.8	49.8	53.9	4.1	
Hori	4882.000	AV	36.3	33.1	5.8	31.3	43.9	53.9	10.0	
Hori	7323.000	AV	32.4	36.8	6.9	32.6	43.5	53.9	10.4	
Hori	9764.000	AV	31.4	38.2	7.7	32.7	44.6	53.9	9.3	
Vert	160.511	QP	39.8	15.6	8.8	31.9	32.3	43.5	11.2	
Vert	206.243	QP	41.1	16.6	9.1	31.8	35.0	43.5	8.5	
Vert	209.919	QP	43.9	16.6	9.2	31.8	37.9	43.5	5.6	
Vert	224.999	QP	49.6	16.8	9.3	31.8	43.9	46.0	2.1	
Vert	666.212	QP	40.8	21.6	12.1	32.2	42.3	46.0	3.7	
Vert	936.001	QP	31.8	25.4	13.5	31.0	39.7	46.0	6.3	
Vert	1265.843	PK	64.5	24.9	2.5	34.2	57.7	73.9	16.2	
Vert	1332.441	PK	61.8	25.1	2.6	34.0	55.5	73.9	18.4	
Vert	1399.293	PK	62.7	25.2	2.6	33.8	56.7	73.9	17.2	
Vert	3145.666	PK	47.2	28.4	3.8	31.8	47.6	73.9	26.3	
Vert	4882.000	PK	45.3	33.1	5.8	31.3	52.9	73.9	21.0	
Vert	7323.000	PK	42.8	36.8	6.9	32.6	53.9	73.9	20.0	
Vert	9764.000	PK	43.2	38.2	7.7	32.7	56.4	73.9	17.5	
Vert	1265.843	AV	39.7	24.9	2.5	34.2	32.9	53.9	21.0	
Vert	1332.441	AV	44.5	25.1	2.6	34.0	38.2	53.9	15.7	
Vert	1399.293	AV	39.2	25.2	2.6	33.8	33.2	53.9	20.7	
Vert	3145.666	AV	43.2	28.4	3.8	31.8	43.6	53.9	10.3	
Vert	4882.000	AV	37.1	33.1	5.8	31.3	44.7	53.9	9.2	
Vert	7323.000	AV	31.3	36.8	6.9	32.6	42.4	53.9	11.5	
Vert	9764.000	AV	31.4	38.2	7.7	32.7	44.6	53.9	9.3	

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

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

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

Radiated Spurious Emission

Report No. 11006397H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4 No.3
Date October 27, 2015 November 4, 2015
Temperature / Humidity 23 deg. C / 58 % RH 23 deg. C / 46 % RH
Engineer Kazuya Yoshioka Kazuya Yoshioka
(Above 1GHz) (Below 1GHz)
Mode Tx, Hopping Off, DH5 2480 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	172.869	QP	39.8	15.9	8.8	32.2	32.3	43.5	11.2	
Hori	224.998	QP	46.0	16.9	9.3	32.1	40.1	46.0	5.9	
Hori	246.947	QP	40.5	17.2	9.5	32.0	35.2	46.0	10.8	
Hori	666.216	QP	41.3	20.1	12.1	32.2	41.3	46.0	4.7	
Hori	799.995	QP	30.4	22.0	12.8	31.5	33.7	46.0	12.3	
Hori	936.001	QP	32.9	22.7	13.5	30.8	38.3	46.0	7.7	
Hori	1265.787	PK	64.5	24.9	2.5	34.2	57.7	73.9	16.2	
Hori	1332.431	PK	64.7	25.1	2.6	34.0	58.4	73.9	15.5	
Hori	1399.030	PK	64.7	25.2	2.6	33.8	58.7	73.9	15.2	
Hori	2483.500	PK	41.6	28.1	3.4	32.1	41.0	73.9	32.9	
Hori	3145.667	PK	51.5	28.4	3.8	31.8	51.9	73.9	22.0	
Hori	4960.000	PK	44.0	33.4	5.8	31.2	52.0	73.9	21.9	
Hori	7440.000	PK	43.6	36.8	6.9	32.7	54.6	73.9	19.3	
Hori	9920.000	PK	42.3	38.3	7.7	32.8	55.5	73.9	18.4	
Hori	1265.787	AV	40.5	24.9	2.5	34.2	33.7	53.9	20.2	
Hori	1332.431	AV	47.2	25.1	2.6	34.0	40.9	53.9	13.0	
Hori	1399.030	AV	40.2	25.2	2.6	33.8	34.2	53.9	19.7	
Hori	2483.500	AV	30.1	28.1	3.4	32.1	29.5	53.9	24.4	
Hori	3145.667	AV	49.4	28.4	3.8	31.8	49.8	53.9	4.1	
Hori	4960.000	AV	34.4	33.4	5.8	31.2	42.4	53.9	11.5	
Hori	7440.000	AV	30.1	36.8	6.9	32.7	41.1	53.9	12.8	
Hori	9920.000	AV	29.7	38.3	7.7	32.8	42.9	53.9	11.0	
Vert	216.009	QP	34.2	16.8	9.2	32.1	28.1	46.0	17.9	
Vert	224.998	QP	43.2	16.9	9.3	32.1	37.3	46.0	8.7	
Vert	274.998	QP	30.6	18.4	9.7	32.0	26.7	46.0	19.3	
Vert	593.384	QP	38.3	19.3	11.7	32.1	37.2	46.0	8.8	
Vert	666.216	QP	41.3	20.1	12.1	32.2	41.3	46.0	4.7	
Vert	936.002	QP	32.8	22.7	13.5	30.8	38.2	46.0	7.8	
Vert	1265.725	PK	63.9	24.9	2.5	34.2	57.1	73.9	16.8	
Vert	1332.391	PK	62.0	25.1	2.6	34.0	55.7	73.9	18.2	
Vert	1399.115	PK	63.3	25.2	2.6	33.8	57.3	73.9	16.6	
Vert	2483.500	PK	42.3	28.1	3.4	32.1	41.7	73.9	32.2	
Vert	3145.575	PK	47.0	28.4	3.8	31.8	47.4	73.9	26.5	
Vert	4960.000	PK	45.0	33.4	5.8	31.2	53.0	73.9	20.9	
Vert	7440.000	PK	41.7	36.8	6.9	32.7	52.7	73.9	21.2	
Vert	9920.000	PK	42.5	38.3	7.7	32.8	55.7	73.9	18.2	
Vert	1265.725	AV	39.4	24.9	2.5	34.2	32.6	53.9	21.3	
Vert	1332.391	AV	44.3	25.1	2.6	34.0	38.0	53.9	15.9	
Vert	1399.115	AV	38.9	25.2	2.6	33.8	32.9	53.9	21.0	
Vert	2483.500	AV	29.0	28.1	3.4	32.1	28.4	53.9	25.5	
Vert	3145.575	AV	43.1	28.4	3.8	31.8	43.5	53.9	10.4	
Vert	4960.000	AV	36.9	33.4	5.8	31.2	44.9	53.9	9.0	
Vert	7440.000	AV	29.8	36.8	6.9	32.7	40.8	53.9	13.1	
Vert	9920.000	AV	29.7	38.3	7.7	32.8	42.9	53.9	11.0	

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

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

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

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Ise EMC Lab.

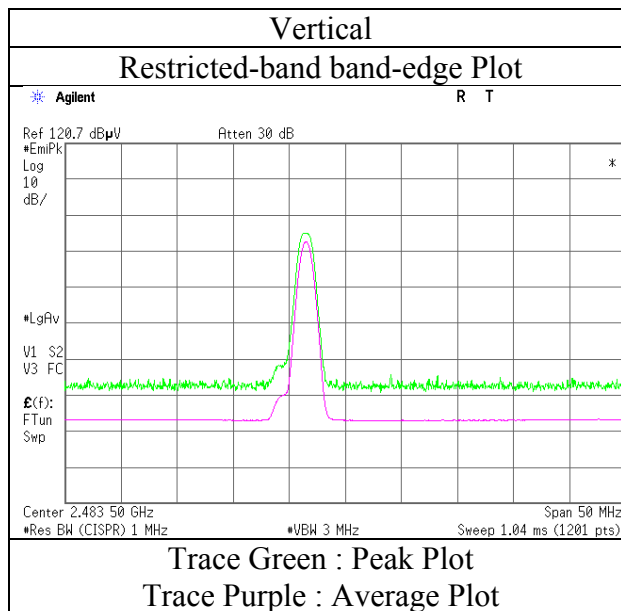
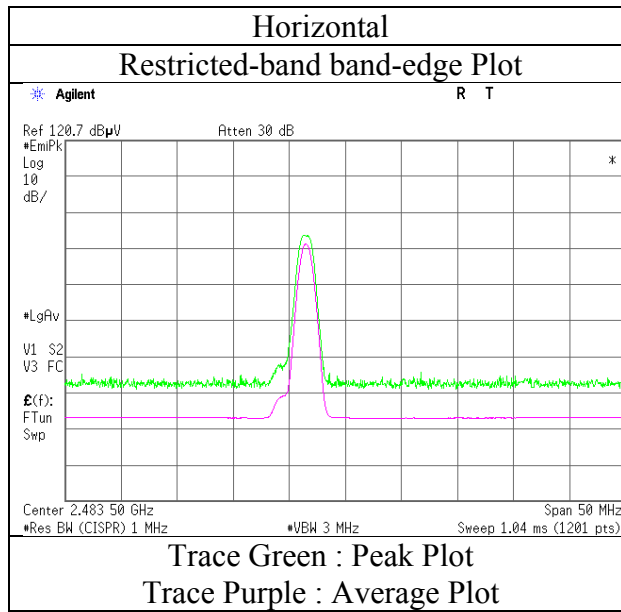
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission **(Reference Plot for band-edge)**

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No.	11006397H
Date	October 27, 2015
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Kazuya Yoshioka
Mode	Tx, Hopping Off, DH5 2480 MHz



* Final result of restricted band edge was shown in tabular data.

UL Japan, Inc.

Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission

Report No. 11006397H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4 No.3
Date October 27, 2015 November 4, 2015
Temperature / Humidity 23 deg. C / 58 % RH 23 deg. C / 46 % RH
Engineer Kazuya Yoshioka Kazuya Yoshioka
(Above 1GHz) (Below 1GHz)
Mode Tx, Hopping Off, 3DH5 2402 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	172.865	QP	39.9	15.9	8.8	32.2	32.4	43.5	11.1	
Hori	224.998	QP	47.6	16.9	9.3	32.1	41.7	46.0	4.3	
Hori	361.320	QP	40.6	16.4	10.4	32.0	35.4	46.0	10.6	
Hori	647.987	QP	36.9	19.9	12.0	32.1	36.7	46.0	9.3	
Hori	666.214	QP	42.8	20.1	12.1	32.2	42.8	46.0	3.2	
Hori	936.002	QP	33.4	22.7	13.5	30.8	38.8	46.0	7.2	
Hori	1265.675	PK	64.0	24.9	2.5	34.2	57.2	73.9	16.7	
Hori	1332.454	PK	65.2	25.1	2.6	34.0	58.9	73.9	15.0	
Hori	1399.108	PK	64.7	25.2	2.6	33.8	58.7	73.9	15.2	
Hori	2390.000	PK	41.3	27.9	3.3	32.1	40.4	73.9	33.5	
Hori	3145.526	PK	51.6	28.4	3.8	31.8	52.0	73.9	21.9	
Hori	4804.000	PK	43.8	32.8	5.7	31.3	51.0	73.9	22.9	
Hori	7206.000	PK	43.7	36.8	6.9	32.6	54.8	73.9	19.1	
Hori	9608.000	PK	44.1	38.1	7.6	32.6	57.2	73.9	16.7	
Hori	1265.675	AV	40.8	24.9	2.5	34.2	34.0	53.9	19.9	
Hori	1332.454	AV	47.5	25.1	2.6	34.0	41.2	53.9	12.7	
Hori	1399.108	AV	40.2	25.2	2.6	33.8	34.2	53.9	19.7	
Hori	2390.000	AV	29.8	27.9	3.3	32.1	28.9	53.9	25.0	
Hori	3145.526	AV	49.3	28.4	3.8	31.8	49.7	53.9	4.2	
Hori	4804.000	AV	30.9	32.8	5.7	31.3	38.1	53.9	15.8	
Hori	7206.000	AV	29.8	36.8	6.9	32.6	40.9	53.9	13.0	
Hori	9608.000	AV	30.6	38.1	7.6	32.6	43.7	53.9	10.2	
Vert	172.859	QP	41.8	15.9	8.8	32.2	34.3	43.5	9.2	
Vert	224.998	QP	41.3	16.9	9.3	32.1	35.4	46.0	10.6	
Vert	296.328	QP	37.4	19.3	9.8	32.0	34.5	46.0	11.5	
Vert	593.400	QP	35.5	19.3	11.7	32.1	34.4	46.0	11.6	
Vert	666.222	QP	42.6	20.1	12.1	32.2	42.6	46.0	3.4	
Vert	936.000	QP	30.6	22.7	13.5	30.8	36.0	46.0	10.0	
Vert	1265.927	PK	63.4	24.9	2.5	34.2	56.6	73.9	17.3	
Vert	1332.435	PK	63.3	25.1	2.6	34.0	57.0	73.9	16.9	
Vert	1399.086	PK	63.5	25.2	2.6	33.8	57.5	73.9	16.4	
Vert	2390.000	PK	41.8	27.9	3.3	32.1	40.9	73.9	33.0	
Vert	3145.664	PK	47.7	28.4	3.8	31.8	48.1	73.9	25.8	
Vert	4804.000	PK	43.6	32.8	5.7	31.3	50.8	73.9	23.1	
Vert	7206.000	PK	43.4	36.8	6.9	32.6	54.5	73.9	19.4	
Vert	9608.000	PK	43.7	38.1	7.6	32.6	56.8	73.9	17.1	
Vert	1265.927	AV	39.4	24.9	2.5	34.2	32.6	53.9	21.3	
Vert	1332.435	AV	44.0	25.1	2.6	34.0	37.7	53.9	16.2	
Vert	1399.086	AV	39.1	25.2	2.6	33.8	33.1	53.9	20.8	
Vert	2390.000	AV	28.5	27.9	3.3	32.1	27.6	53.9	26.3	
Vert	3145.664	AV	42.8	28.4	3.8	31.8	43.2	53.9	10.7	
Vert	4804.000	AV	32.2	32.8	5.7	31.3	39.4	53.9	14.5	
Vert	7206.000	AV	29.8	36.8	6.9	32.6	40.9	53.9	13.0	
Vert	9608.000	AV	30.6	38.1	7.6	32.6	43.7	53.9	10.2	

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

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

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

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	96.1	28.0	3.3	32.1	95.3	-	-	Carrier
Hori	2400.000	PK	39.2	28.0	3.3	32.1	38.4	75.3	36.9	
Vert	2402.000	PK	93.7	28.0	3.3	32.1	92.9	-	-	Carrier
Vert	2400.000	PK	39.1	28.0	3.3	32.1	38.3	72.9	34.6	

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

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Ise EMC Lab.

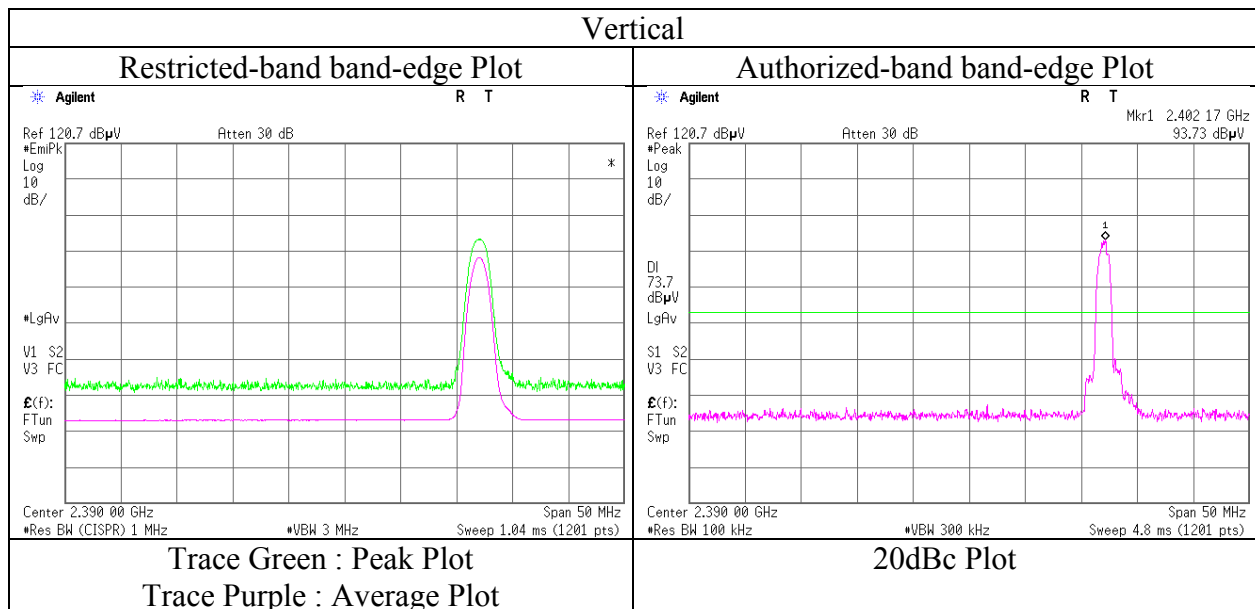
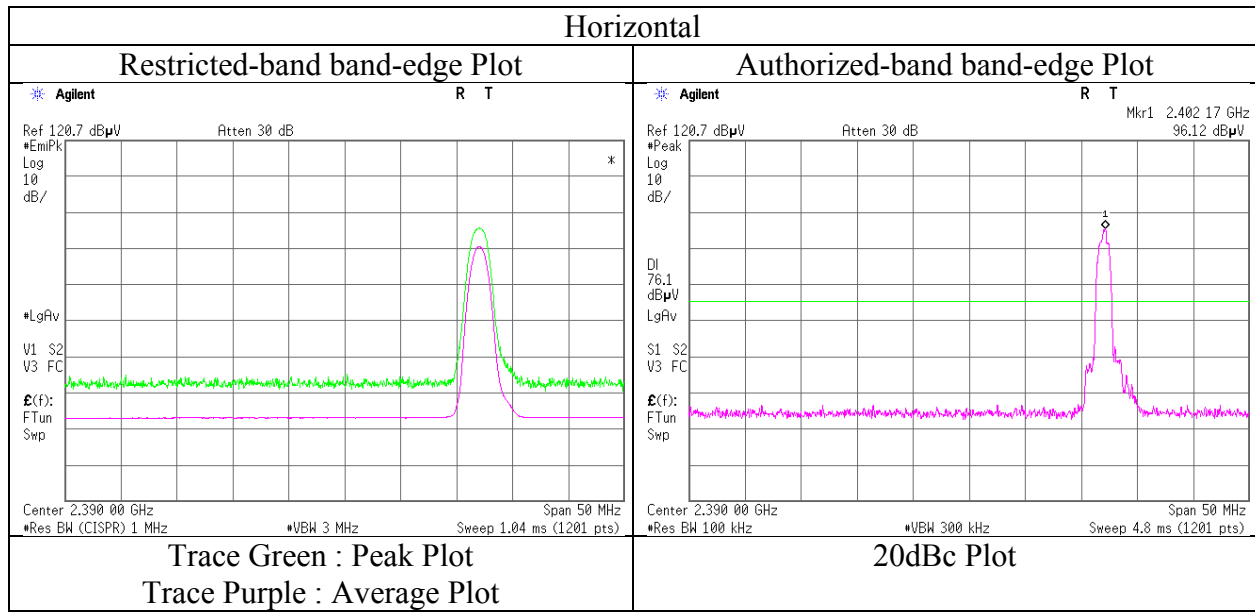
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No.	11006397H
Date	October 27, 2015
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Kazuya Yoshioka
Mode	Tx, Hopping Off, 3DH5 2402 MHz



* Final result of restricted band edge was shown in tabular data.

UL Japan, Inc.

Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission

Report No. 11006397H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4 No.3
Date October 27, 2015 November 4, 2015
Temperature / Humidity 23 deg. C / 58 % RH 23 deg. C / 46 % RH
Engineer Kazuya Yoshioka Kazuya Yoshioka
(Above 1GHz) (Below 1GHz)
Mode Tx, Hopping Off, 3DH5 2441 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	224.998	QP	48.5	16.9	9.3	32.1	42.6	46.0	3.4	
Hori	246.944	QP	38.8	17.2	9.5	32.0	33.5	46.0	12.5	
Hori	361.332	QP	41.2	16.4	10.4	32.0	36.0	46.0	10.0	
Hori	648.000	QP	37.1	19.9	12.0	32.1	36.9	46.0	9.1	
Hori	666.205	QP	42.5	20.1	12.1	32.2	42.5	46.0	3.5	
Hori	936.001	QP	33.3	22.7	13.5	30.8	38.7	46.0	7.3	
Hori	1265.745	PK	64.7	24.9	2.5	34.2	57.9	73.9	16.0	
Hori	1332.485	PK	65.3	25.1	2.6	34.0	59.0	73.9	14.9	
Hori	1398.976	PK	63.4	25.2	2.6	33.8	57.4	73.9	16.5	
Hori	3145.699	PK	51.9	28.4	3.8	31.8	52.3	73.9	21.6	
Hori	4882.000	PK	42.9	33.1	5.8	31.3	50.5	73.9	23.4	
Hori	7323.000	PK	42.0	36.8	6.9	32.6	53.1	73.9	20.8	
Hori	9764.000	PK	42.8	38.2	7.7	32.7	56.0	73.9	17.9	
Hori	1265.745	AV	40.9	24.9	2.5	34.2	34.1	53.9	19.8	
Hori	1332.485	AV	47.9	25.1	2.6	34.0	41.6	53.9	12.3	
Hori	1398.976	AV	38.9	25.2	2.6	33.8	32.9	53.9	21.0	
Hori	3145.699	AV	49.1	28.4	3.8	31.8	49.5	53.9	4.4	
Hori	4882.000	AV	32.9	33.1	5.8	31.3	40.5	53.9	13.4	
Hori	7323.000	AV	30.0	36.8	6.9	32.6	41.1	53.9	12.8	
Hori	9764.000	AV	31.6	38.2	7.7	32.7	44.8	53.9	9.1	
Vert	172.860	QP	42.2	15.9	8.8	32.2	34.7	43.5	8.8	
Vert	224.992	QP	46.5	16.9	9.3	32.1	40.6	46.0	5.4	
Vert	246.942	QP	39.9	17.2	9.5	32.0	34.6	46.0	11.4	
Vert	296.324	QP	38.4	19.3	9.8	32.0	35.5	46.0	10.5	
Vert	666.200	QP	42.4	20.1	12.1	32.2	42.4	46.0	3.6	
Vert	936.002	QP	30.5	22.7	13.5	30.8	35.9	46.0	10.1	
Vert	1265.615	PK	63.5	24.9	2.5	34.2	56.7	73.9	17.2	
Vert	1332.491	PK	63.4	25.1	2.6	34.0	57.1	73.9	16.8	
Vert	1399.099	PK	62.6	25.2	2.6	33.8	56.6	73.9	17.3	
Vert	3145.749	PK	47.0	28.4	3.8	31.8	47.4	73.9	26.5	
Vert	4882.000	PK	43.7	33.1	5.8	31.3	51.3	73.9	22.6	
Vert	7323.000	PK	42.3	36.8	6.9	32.6	53.4	73.9	20.5	
Vert	9764.000	PK	43.0	38.2	7.7	32.7	56.2	73.9	17.7	
Vert	1265.615	AV	38.9	24.9	2.5	34.2	32.1	53.9	21.8	
Vert	1332.491	AV	45.4	25.1	2.6	34.0	39.1	53.9	14.8	
Vert	1399.099	AV	38.2	25.2	2.6	33.8	32.2	53.9	21.7	
Vert	3145.749	AV	43.0	28.4	3.8	31.8	43.4	53.9	10.5	
Vert	4882.000	AV	33.9	33.1	5.8	31.3	41.5	53.9	12.4	
Vert	7323.000	AV	30.0	36.8	6.9	32.6	41.1	53.9	12.8	
Vert	9764.000	AV	31.6	38.2	7.7	32.7	44.8	53.9	9.1	

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

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

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

Radiated Spurious Emission

Report No. 11006397H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4 No.3
Date October 27, 2015 November 4, 2015
Temperature / Humidity 23 deg. C / 58 % RH 23 deg. C / 46 % RH
Engineer Kazuya Yoshioka Kazuya Yoshioka
(Above 1GHz) (Below 1GHz)
Mode Tx, Hopping Off, 3DH5 2480 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	172.860	QP	40.8	15.9	8.8	32.2	33.3	43.5	10.2	
Hori	224.996	QP	48.4	16.9	9.3	32.1	42.5	46.0	3.5	
Hori	361.320	QP	40.5	16.4	10.4	32.0	35.3	46.0	10.7	
Hori	647.990	QP	37.0	19.9	12.0	32.1	36.8	46.0	9.2	
Hori	666.200	QP	43.5	20.1	12.1	32.2	43.5	46.0	2.5	
Hori	935.999	QP	33.3	22.7	13.5	30.8	38.7	46.0	7.3	
Hori	1265.785	PK	64.8	24.9	2.5	34.2	58.0	73.9	15.9	
Hori	1332.543	PK	65.7	25.1	2.6	34.0	59.4	73.9	14.5	
Hori	1399.061	PK	62.2	25.2	2.6	33.8	56.2	73.9	17.7	
Hori	2483.500	PK	41.8	28.1	3.4	32.1	41.2	73.9	32.7	
Hori	3145.706	PK	51.4	28.4	3.8	31.8	51.8	73.9	22.1	
Hori	4960.000	PK	42.8	33.4	5.8	31.2	50.8	73.9	23.1	
Hori	7440.000	PK	41.6	36.8	6.9	32.7	52.6	73.9	21.3	
Hori	9920.000	PK	42.9	38.3	7.7	32.8	56.1	73.9	17.8	
Hori	1265.785	AV	41.2	24.9	2.5	34.2	34.4	53.9	19.5	
Hori	1332.543	AV	47.9	25.1	2.6	34.0	41.6	53.9	12.3	
Hori	1399.061	AV	38.8	25.2	2.6	33.8	32.8	53.9	21.1	
Hori	2483.500	AV	30.5	28.1	3.4	32.1	29.9	53.9	24.0	
Hori	3145.706	AV	48.9	28.4	3.8	31.8	49.3	53.9	4.6	
Hori	4960.000	AV	30.7	33.4	5.8	31.2	38.7	53.9	15.2	
Hori	7440.000	AV	28.4	36.8	6.9	32.7	39.4	53.9	14.5	
Hori	9920.000	AV	29.8	38.3	7.7	32.8	43.0	53.9	10.9	
Vert	174.989	QP	40.0	16.0	8.8	32.2	32.6	43.5	10.9	
Vert	224.999	QP	46.4	16.9	9.3	32.1	40.5	46.0	5.5	
Vert	246.943	QP	39.6	17.2	9.5	32.0	34.3	46.0	11.7	
Vert	593.360	QP	35.4	19.3	11.7	32.1	34.3	46.0	11.7	
Vert	666.208	QP	42.6	20.1	12.1	32.2	42.6	46.0	3.4	
Vert	936.001	QP	30.5	22.7	13.5	30.8	35.9	46.0	10.1	
Vert	1265.695	PK	62.6	24.9	2.5	34.2	55.8	73.9	18.1	
Vert	1332.431	PK	64.1	25.1	2.6	34.0	57.8	73.9	16.1	
Vert	1399.011	PK	63.7	25.2	2.6	33.8	57.7	73.9	16.2	
Vert	2483.500	PK	41.9	28.1	3.4	32.1	41.3	73.9	32.6	
Vert	3145.666	PK	47.3	28.4	3.8	31.8	47.7	73.9	26.2	
Vert	4960.000	PK	43.3	33.4	5.8	31.2	51.3	73.9	22.6	
Vert	7440.000	PK	42.0	36.8	6.9	32.7	53.0	73.9	20.9	
Vert	9920.000	PK	43.1	38.3	7.7	32.8	56.3	73.9	17.6	
Vert	1265.695	AV	39.1	24.9	2.5	34.2	32.3	53.9	21.6	
Vert	1332.431	AV	45.8	25.1	2.6	34.0	39.5	53.9	14.4	
Vert	1399.011	AV	39.6	25.2	2.6	33.8	33.6	53.9	20.3	
Vert	2483.500	AV	29.3	28.1	3.4	32.1	28.7	53.9	25.2	
Vert	3145.666	AV	42.5	28.4	3.8	31.8	42.9	53.9	11.0	
Vert	4960.000	AV	33.1	33.4	5.8	31.2	41.1	53.9	12.8	
Vert	7440.000	AV	28.4	36.8	6.9	32.7	39.4	53.9	14.5	
Vert	9920.000	AV	29.8	38.3	7.7	32.8	43.0	53.9	10.9	

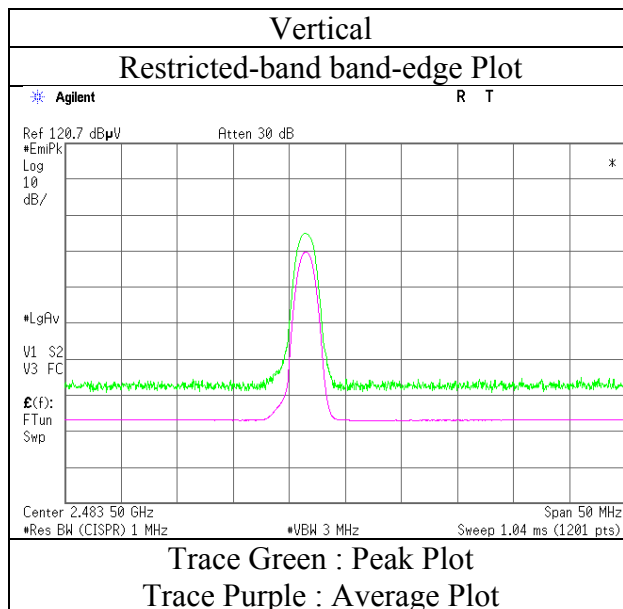
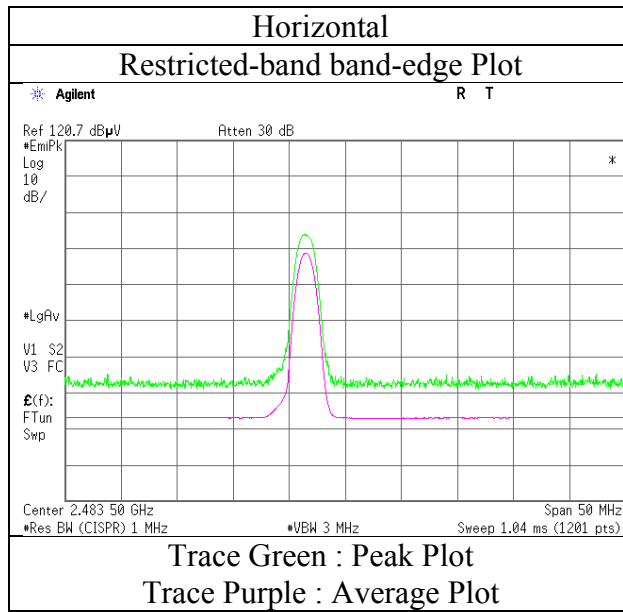
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10 GHz)) - Gain(Amplifier)

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

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

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No.	11006397H
Date	October 27, 2015
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Kazuya Yoshioka
Mode	Tx, Hopping Off, 3DH5 2480 MHz



* Final result of restricted band edge was shown in tabular data.

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Ise EMC Lab.

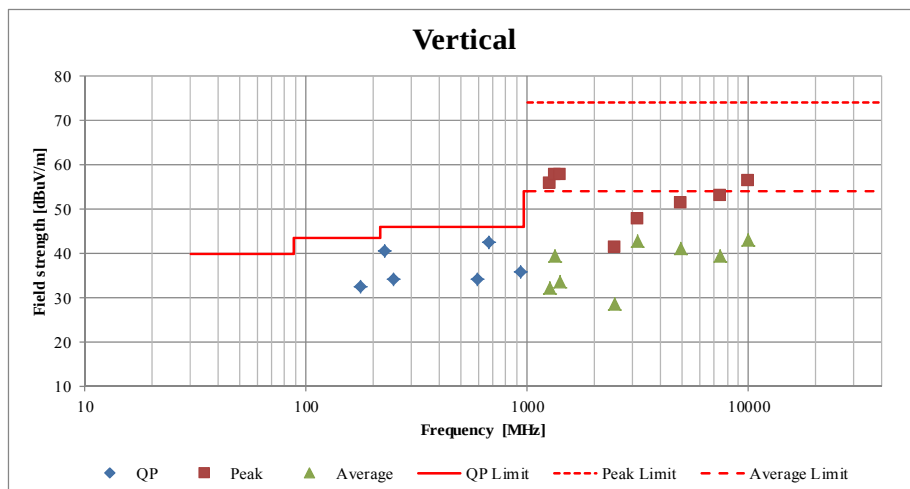
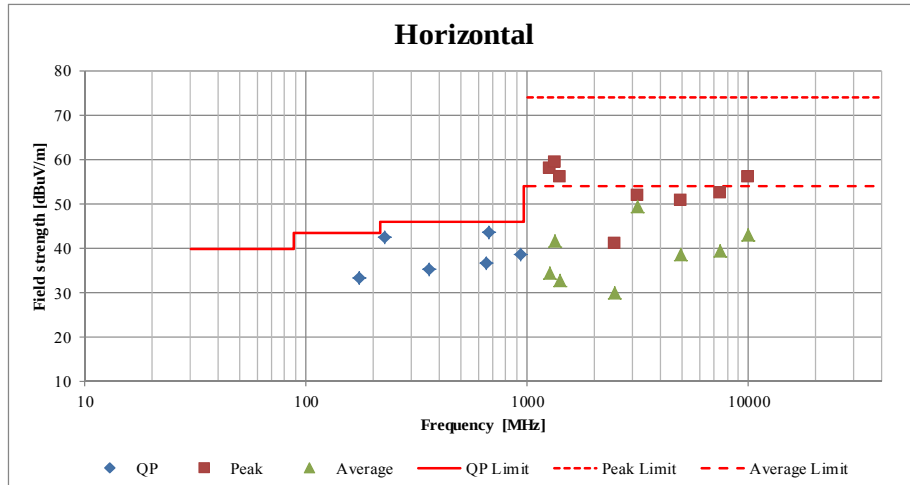
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Facsimile : +81 596 24 8124

Radiated Spurious Emission (Plot data, Worst case)

Report No.	11006397H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.3
Date	October 27, 2015	November 4, 2015
Temperature / Humidity	23 deg. C / 58 % RH	23 deg. C / 46 % RH
Engineer	Kazuya Yoshioka (Above 1GHz)	Kazuya Yoshioka (Below 1GHz)
Mode	Tx, Hopping Off, 3DH5 2480 MHz	



*These plots data contains sufficient number to show the trend of characteristic features for EUT.

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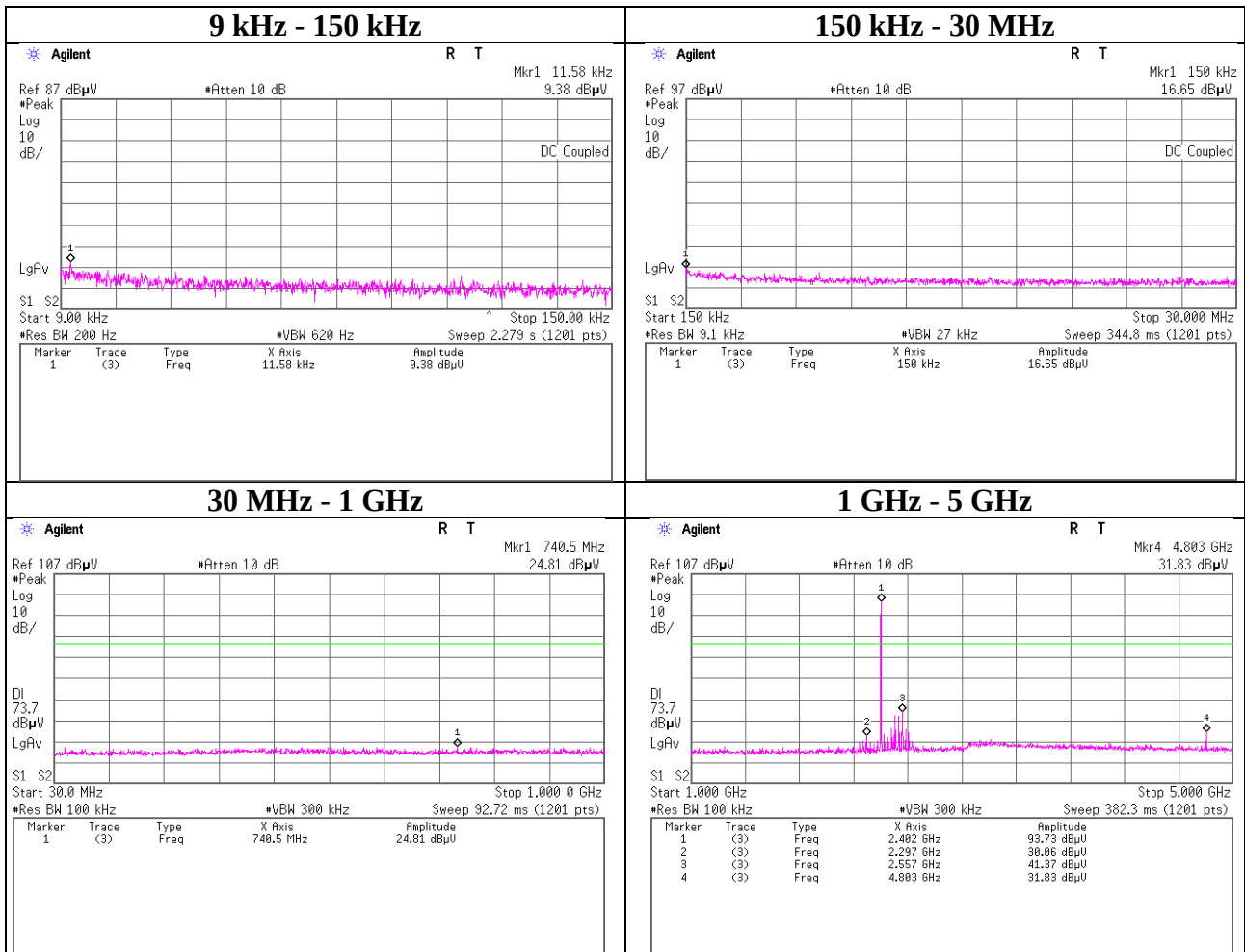
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place : Ise EMC Lab. No.11 Measurement Room
Report No. : 11006397H
Date : October 27, 2015
Temperature / Humidity : 23 deg. C / 57 % RH
Engineer : Ken Fujita
Mode : Tx, Hopping Off, DH5

2402 MHz



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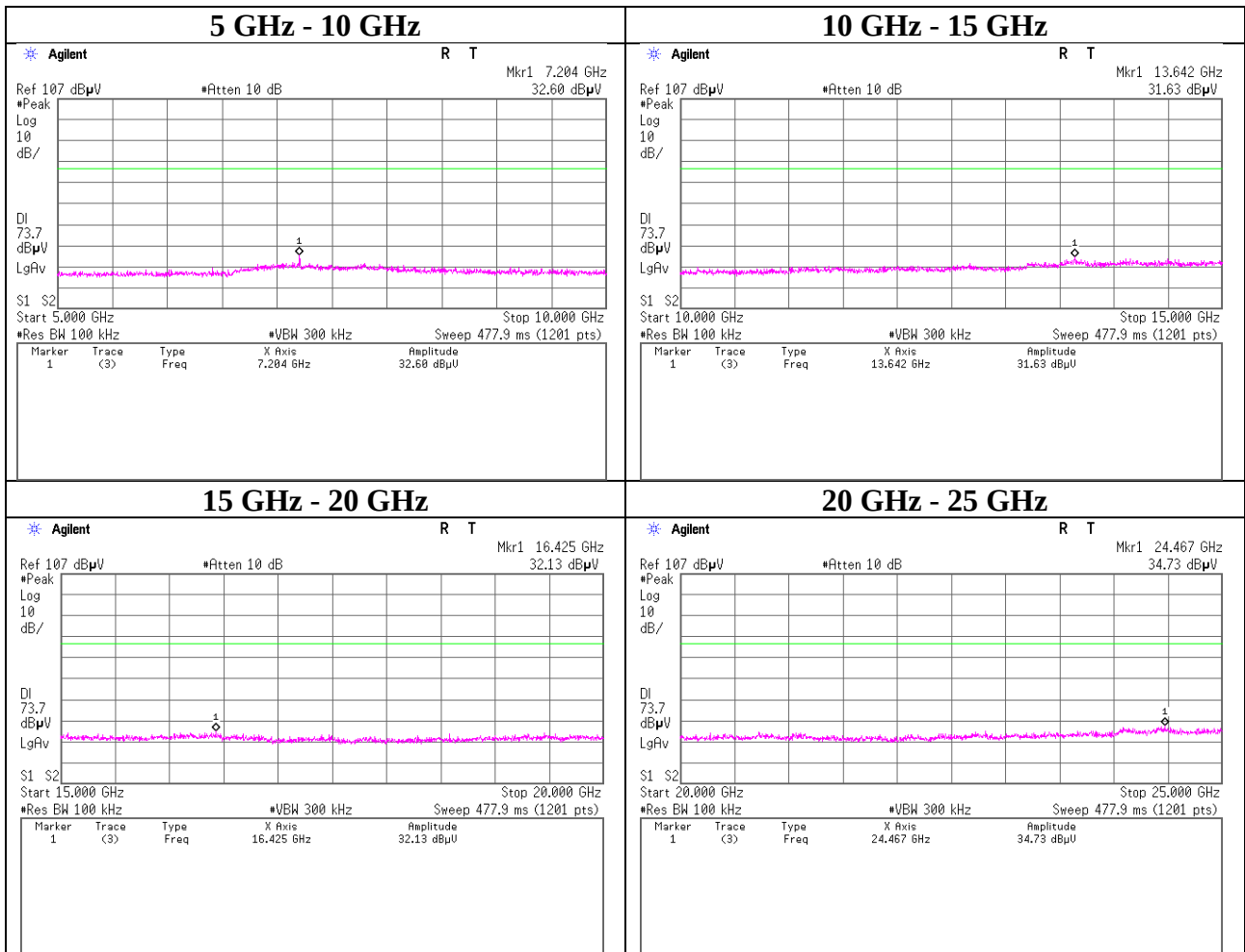
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11006397H
Date	October 27, 2015
Temperature / Humidity	23 deg. C / 57 % RH
Engineer	Ken Fujita
Mode	Tx, Hopping Off, DH5

2402 MHz



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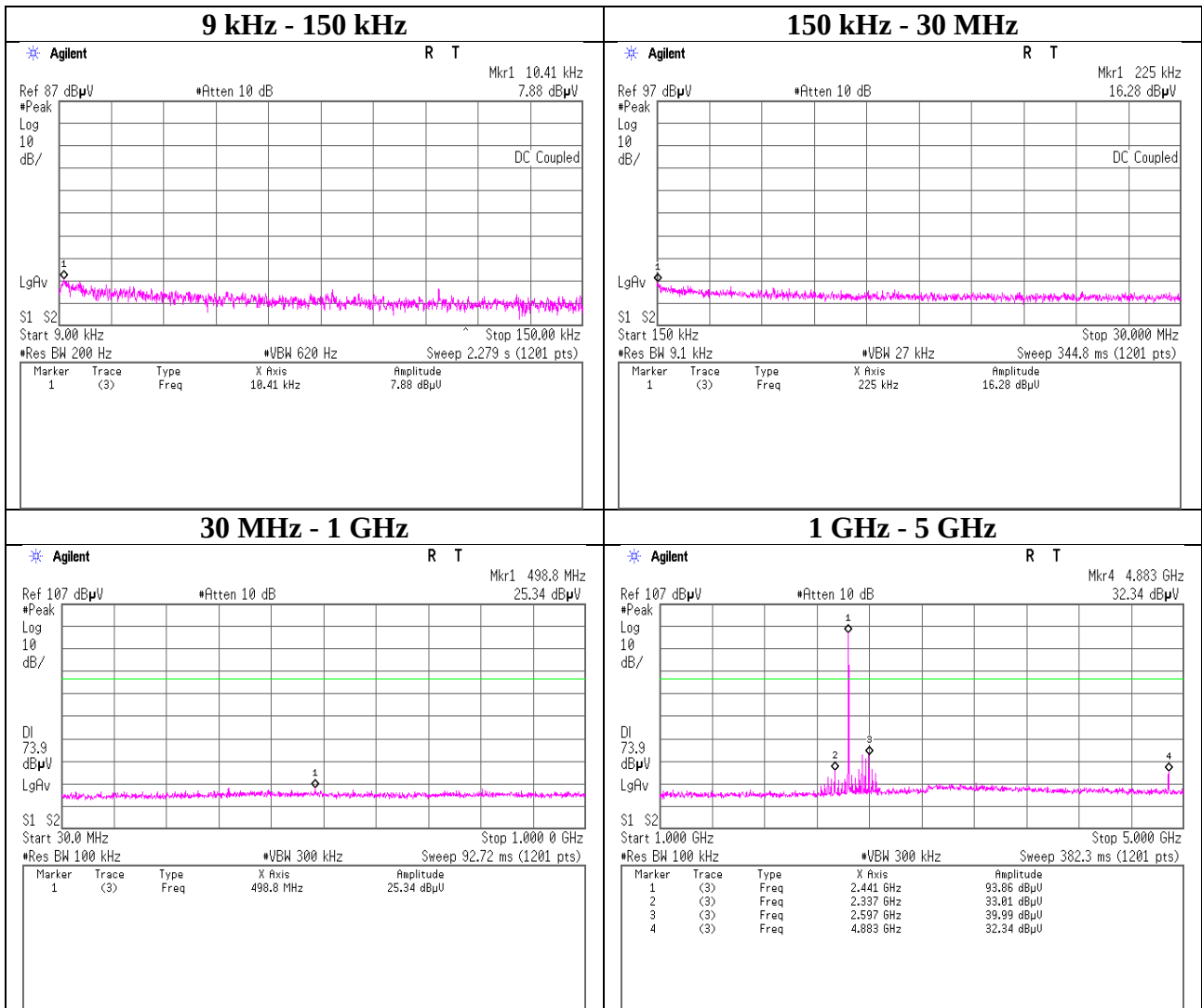
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11006397H
Date	October 27, 2015
Temperature / Humidity	23 deg. C / 57 % RH
Engineer	Ken Fujita
Mode	Tx, Hopping Off, DH5

2441 MHz



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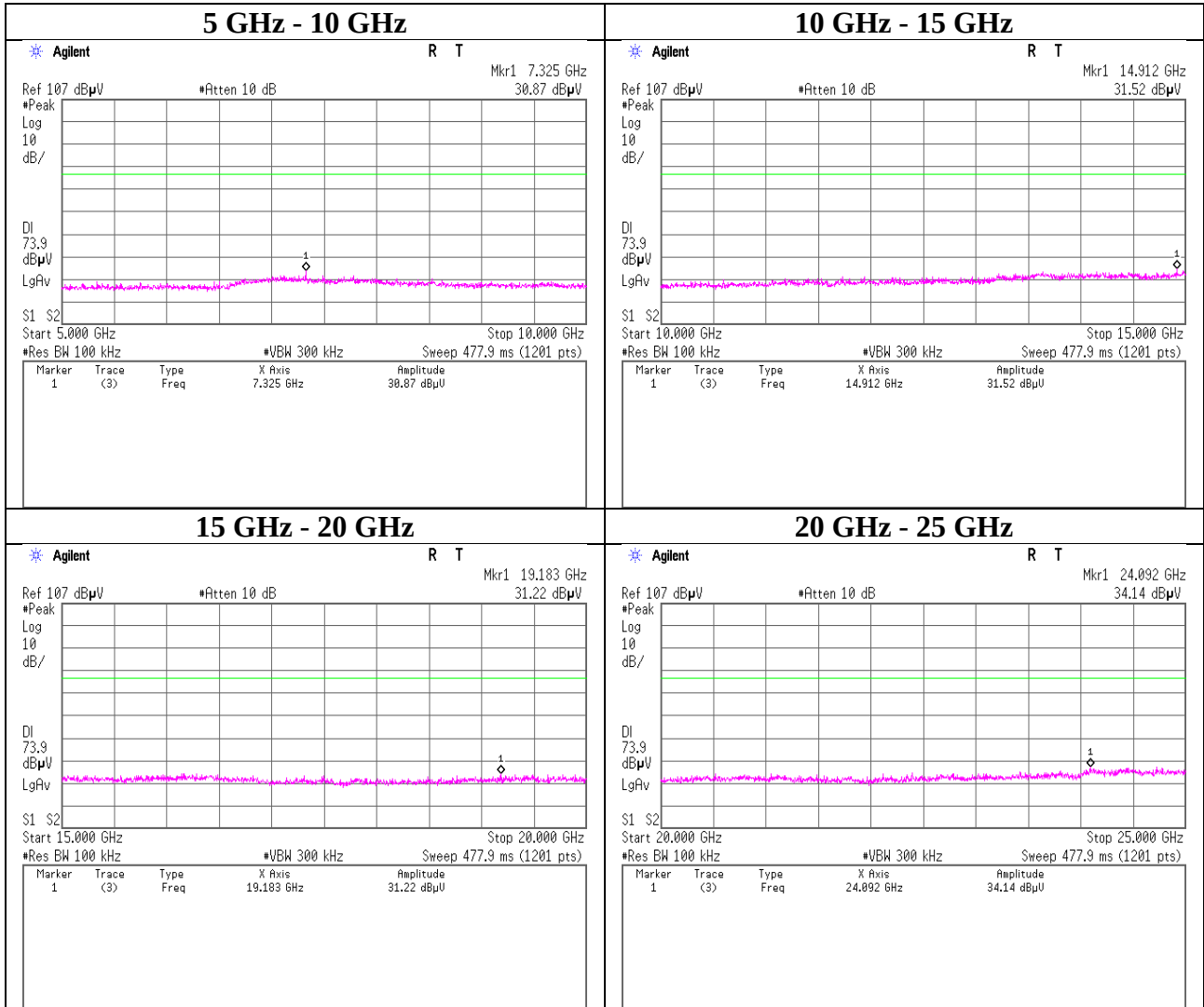
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place : Ise EMC Lab. No.11 Measurement Room
Report No. : 11006397H
Date : October 27, 2015
Temperature / Humidity : 23 deg. C / 57 % RH
Engineer : Ken Fujita
Mode : Tx, Hopping Off, DH5

2441 MHz



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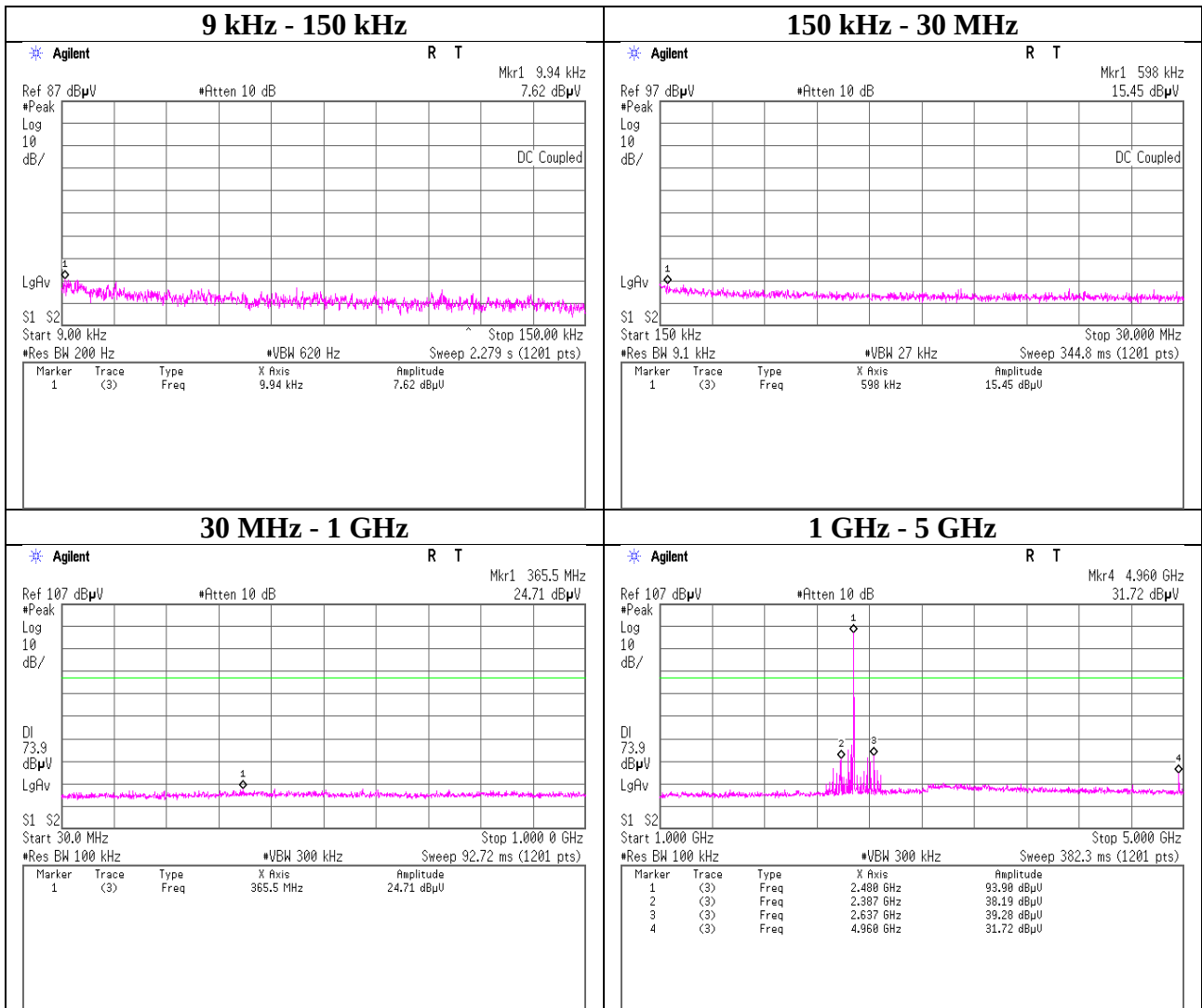
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11006397H
Date	October 27, 2015
Temperature / Humidity	23 deg. C / 57 % RH
Engineer	Ken Fujita
Mode	Tx, Hopping Off, DH5

2480 MHz



UL Japan, Inc.

Ise EMC Lab.

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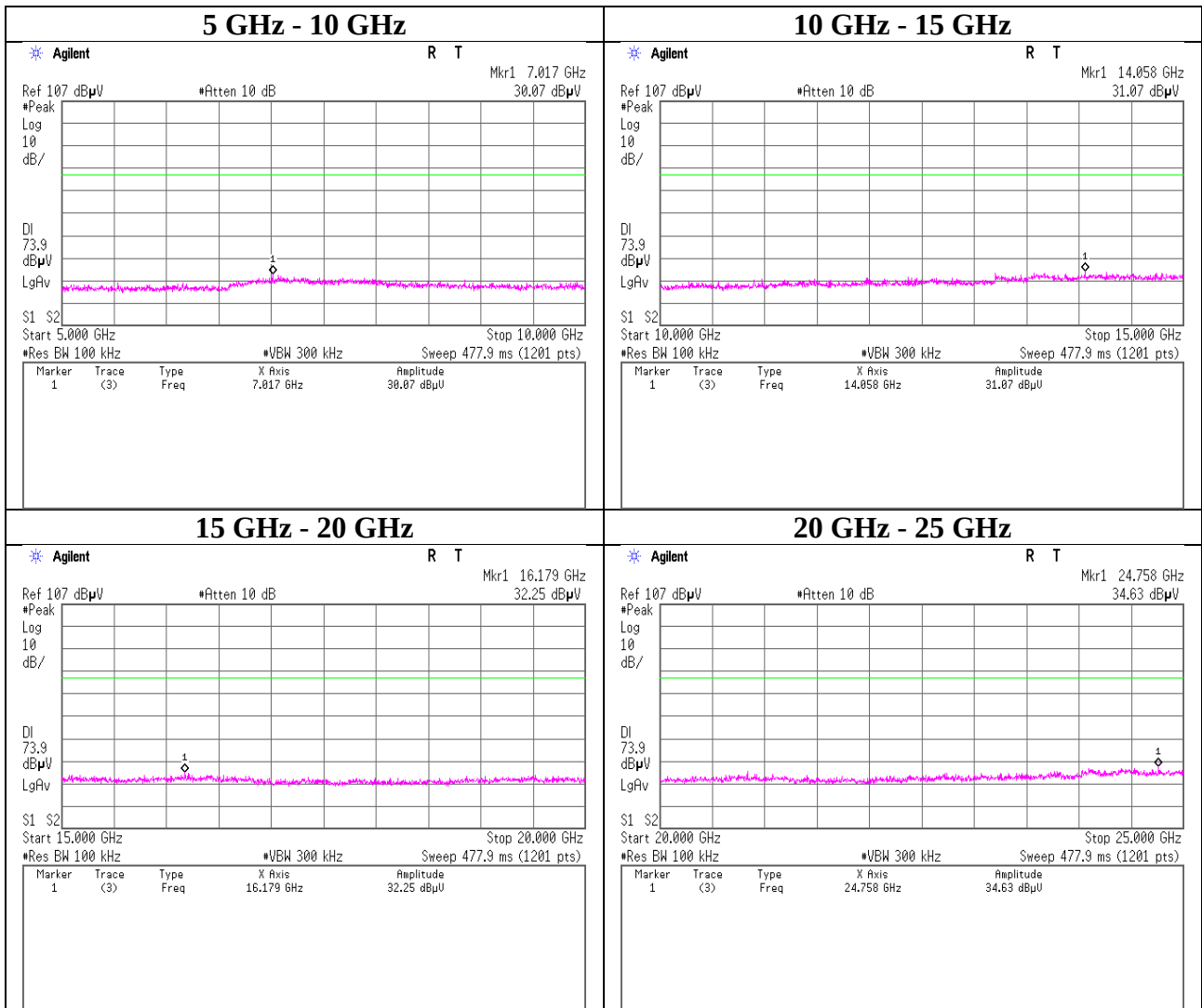
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11006397H
Date	October 27, 2015
Temperature / Humidity	23 deg. C / 57 % RH
Engineer	Ken Fujita
Mode	Tx, Hopping Off, DH5

2480 MHz



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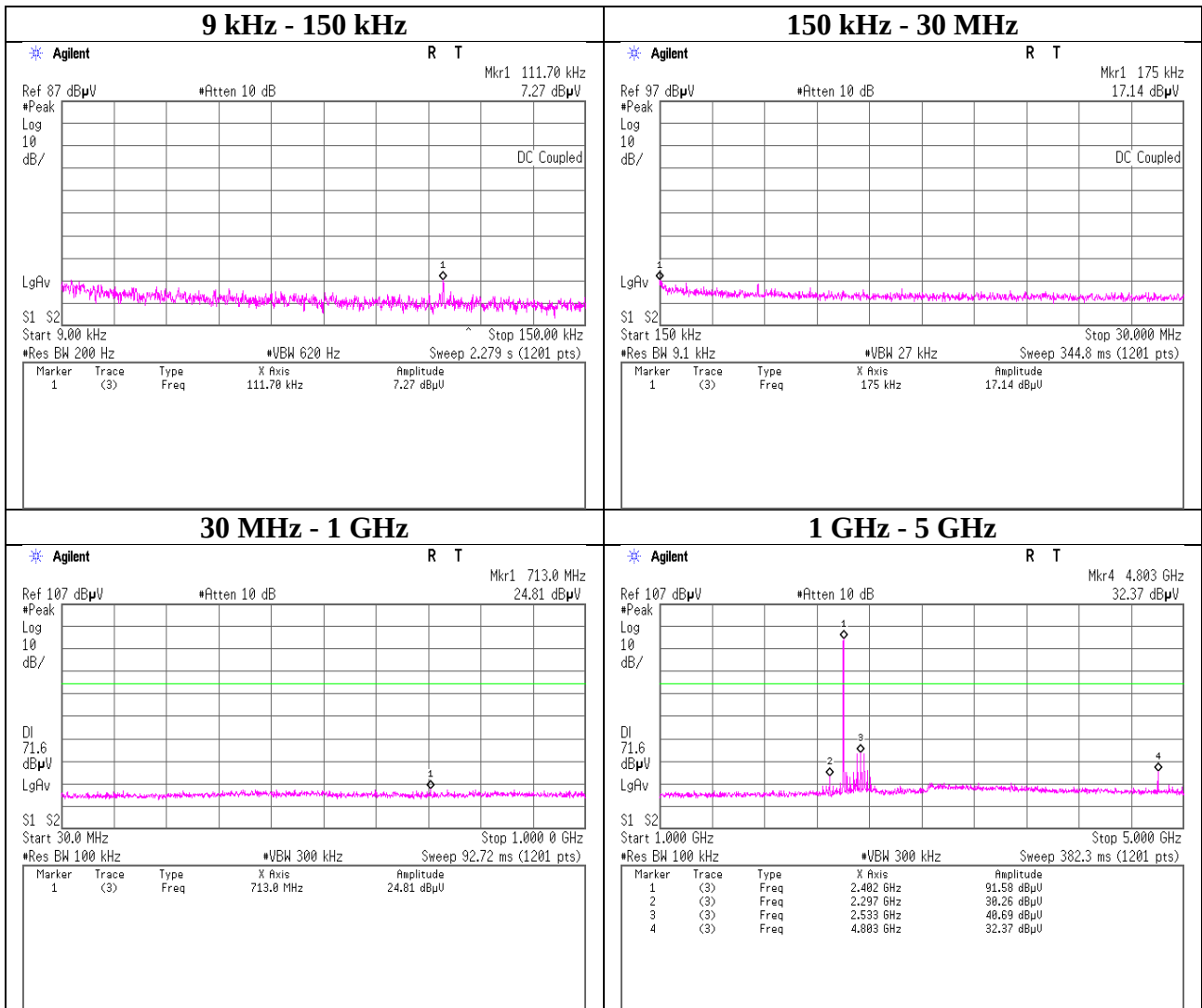
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11006397H
Date	October 27, 2015
Temperature / Humidity	23 deg. C / 57 % RH
Engineer	Ken Fujita
Mode	Tx, Hopping Off, 3DH5

2402 MHz



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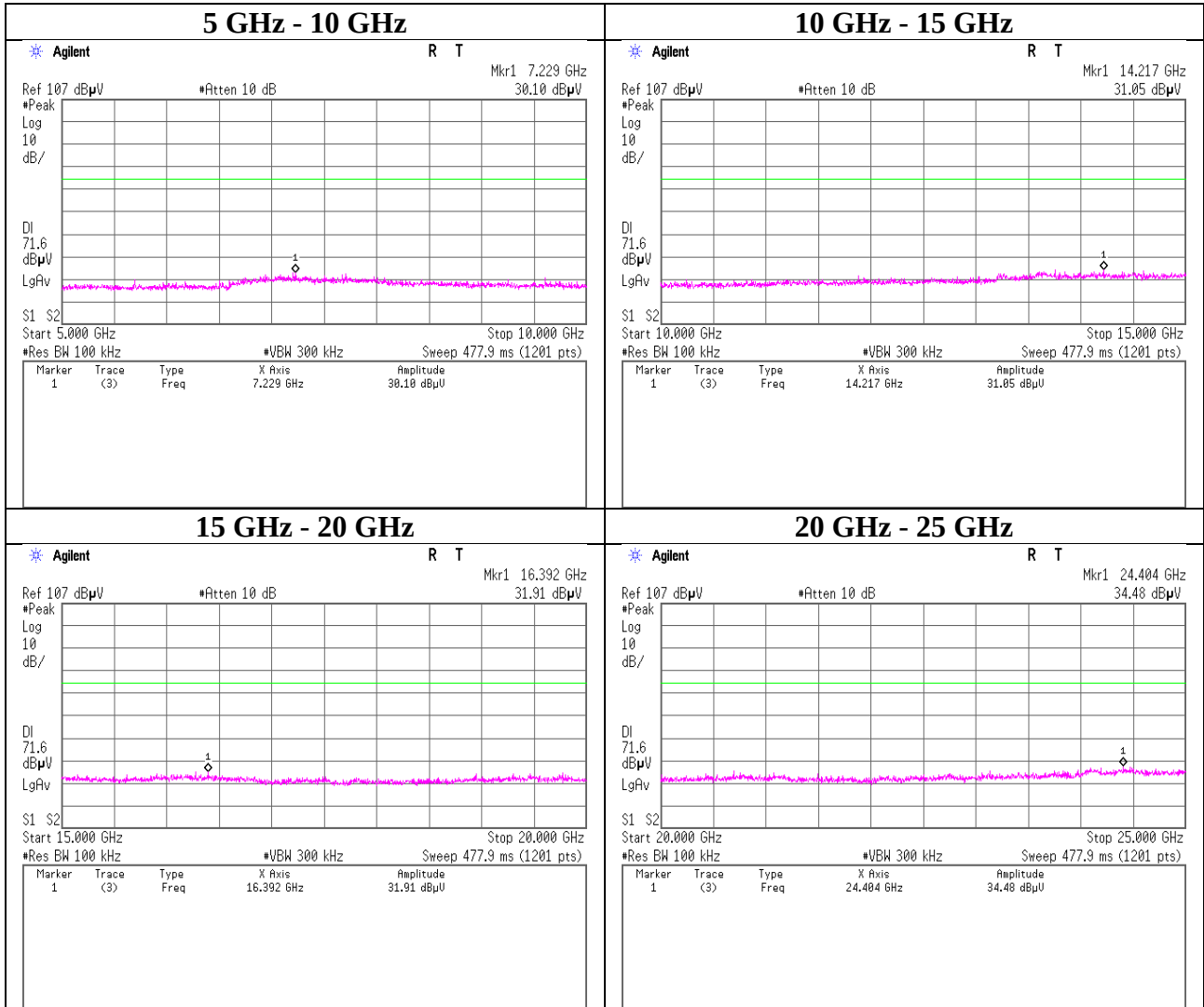
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11006397H
Date	October 27, 2015
Temperature / Humidity	23 deg. C / 57 % RH
Engineer	Ken Fujita
Mode	Tx, Hopping Off, 3DH5

2402 MHz



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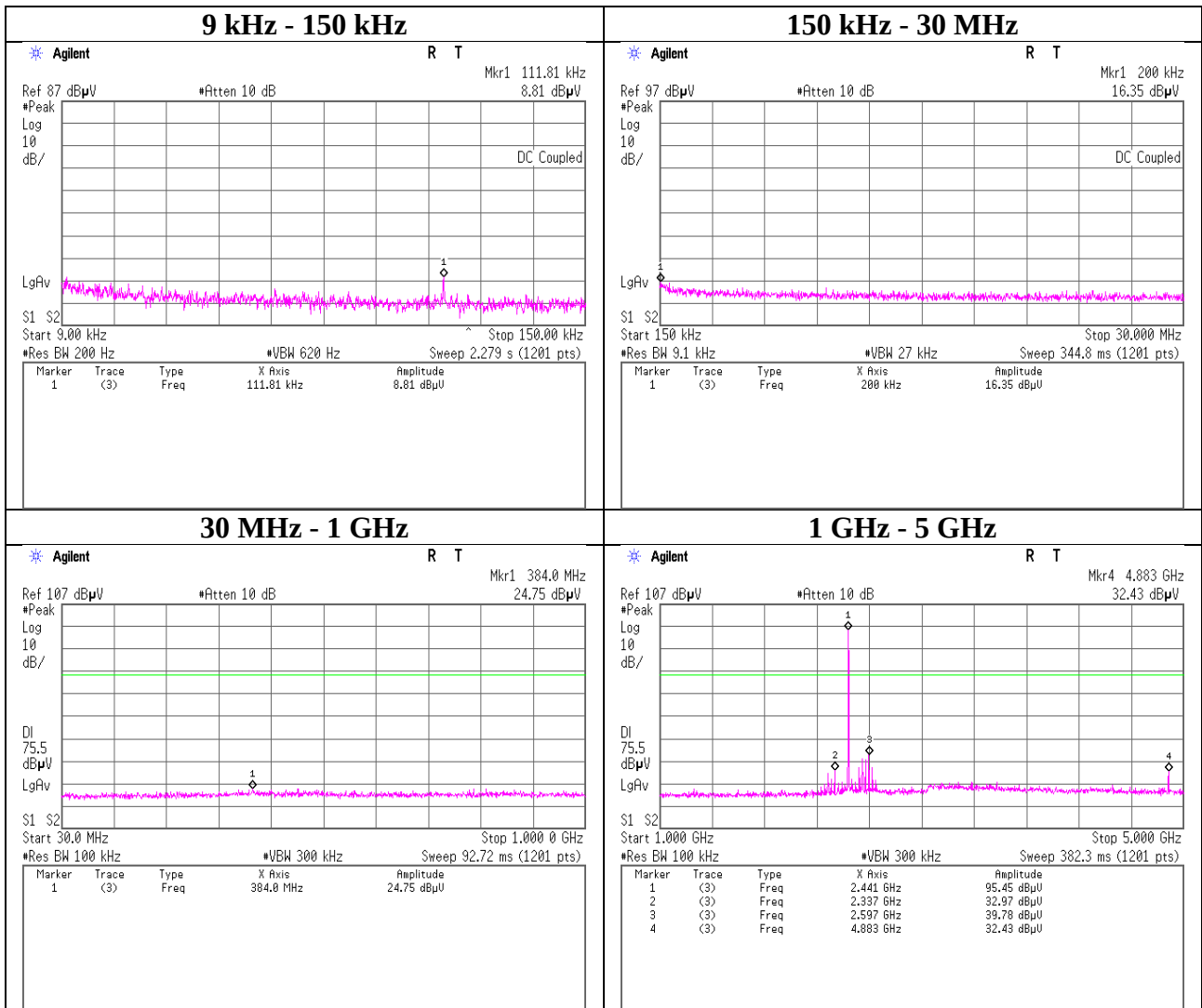
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11006397H
Date	October 27, 2015
Temperature / Humidity	23 deg. C / 57 % RH
Engineer	Ken Fujita
Mode	Tx, Hopping Off, 3DH5

2441 MHz



UL Japan, Inc.

Ise EMC Lab.

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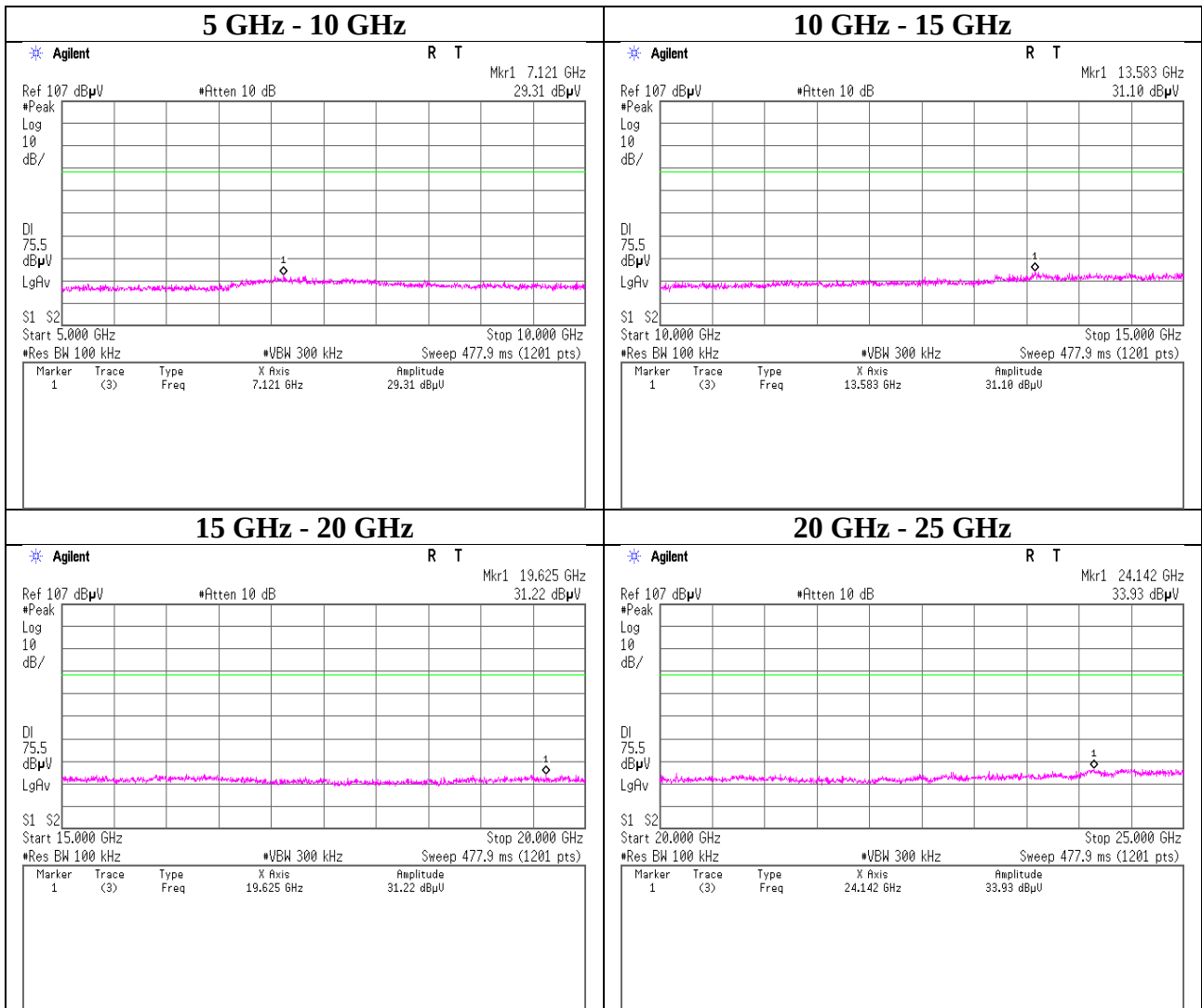
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11006397H
Date	October 27, 2015
Temperature / Humidity	23 deg. C / 57 % RH
Engineer	Ken Fujita
Mode	Tx, Hopping Off, 3DH5

2441 MHz



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Ise EMC Lab.

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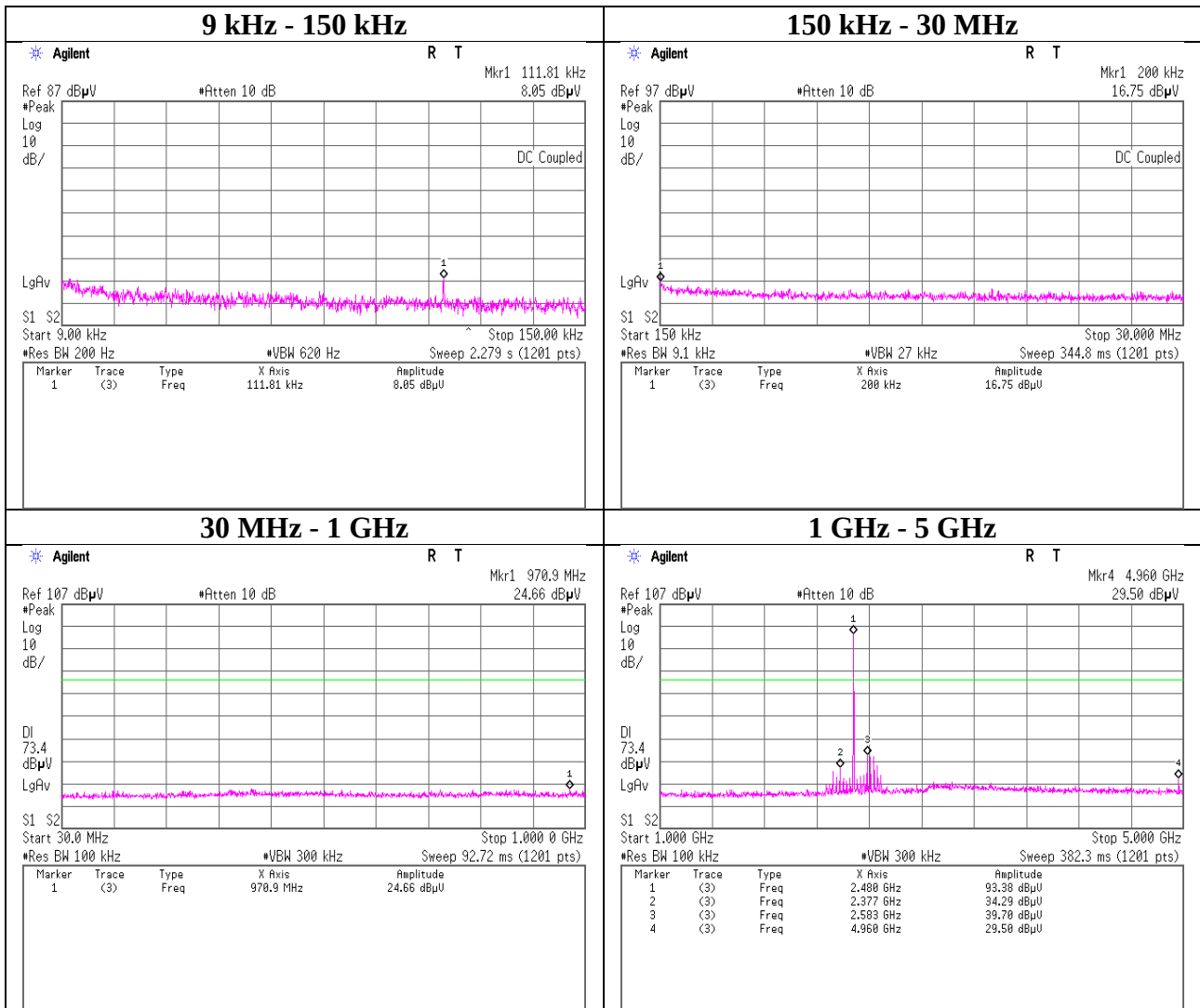
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place : Ise EMC Lab. No.11 Measurement Room
Report No. : 11006397H
Date : October 27, 2015
Temperature / Humidity : 23 deg. C / 57 % RH
Engineer : Ken Fujita
Mode : Tx, Hopping Off, 3DH5

2480 MHz



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Ise EMC Lab.

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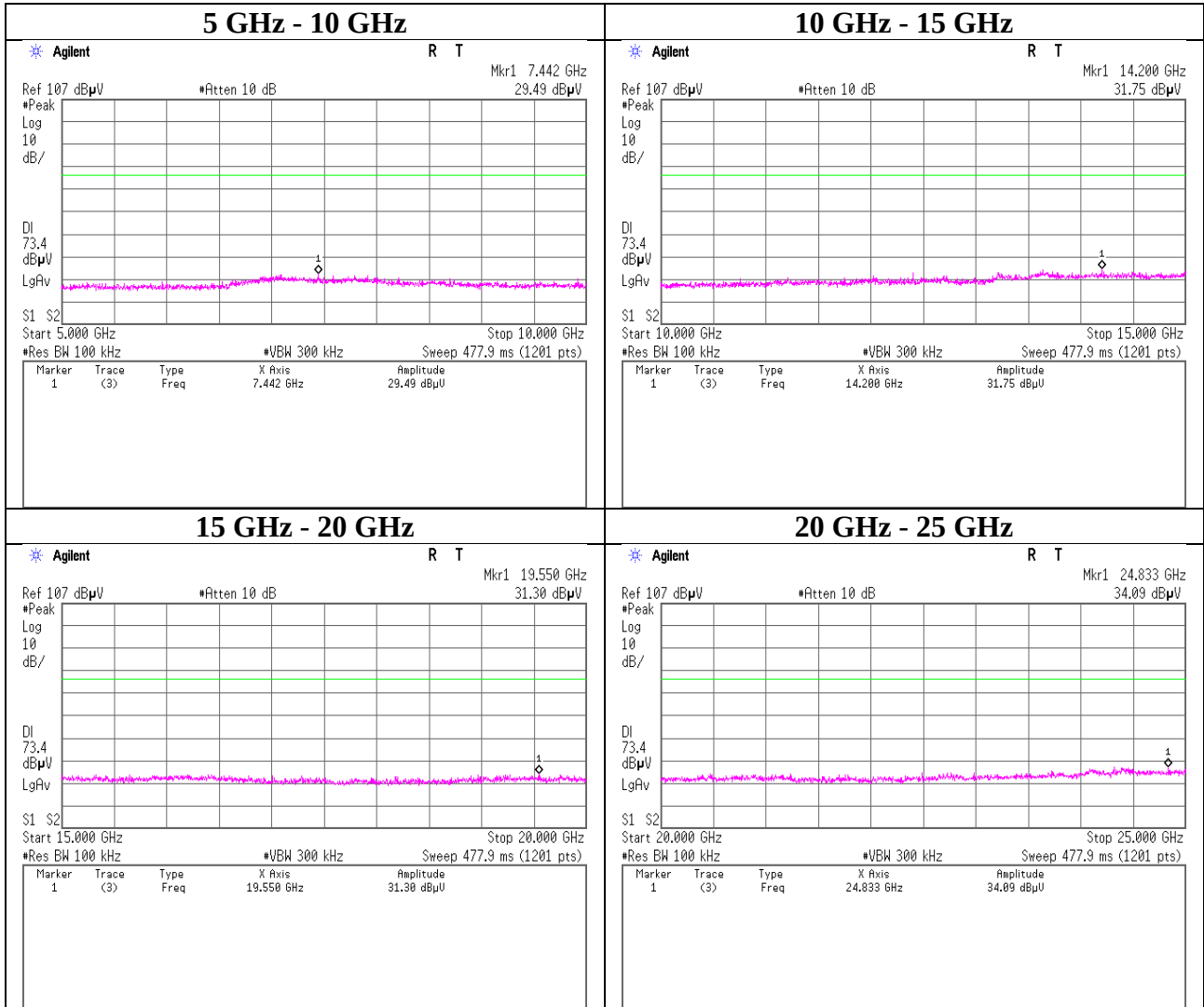
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11006397H
Date	October 27, 2015
Temperature / Humidity	23 deg. C / 57 % RH
Engineer	Ken Fujita
Mode	Tx, Hopping Off, 3DH5

2480 MHz



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Ise EMC Lab.

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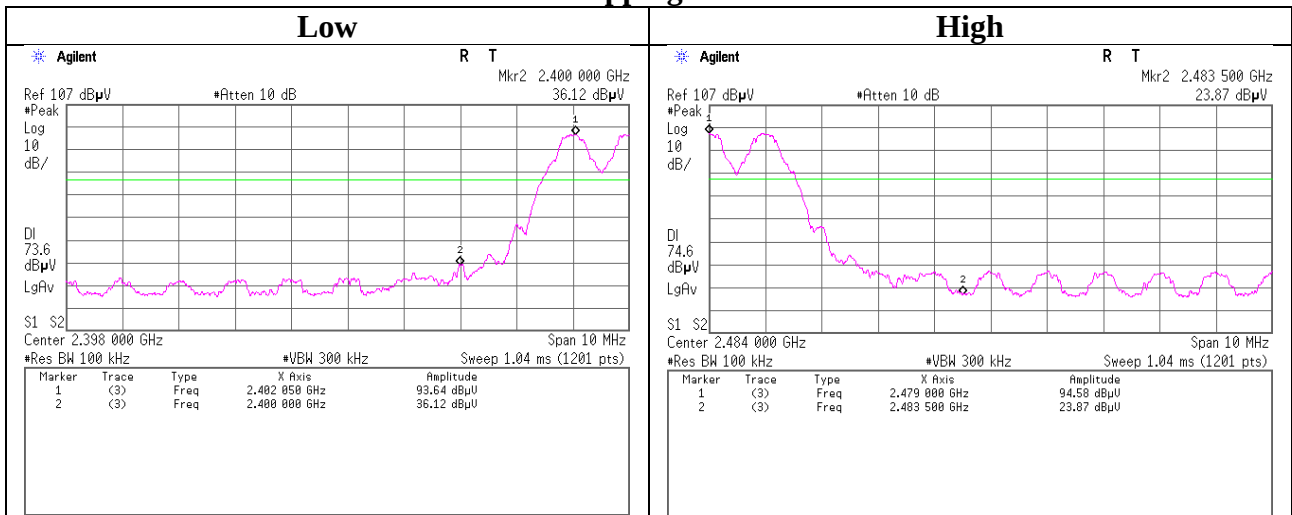
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

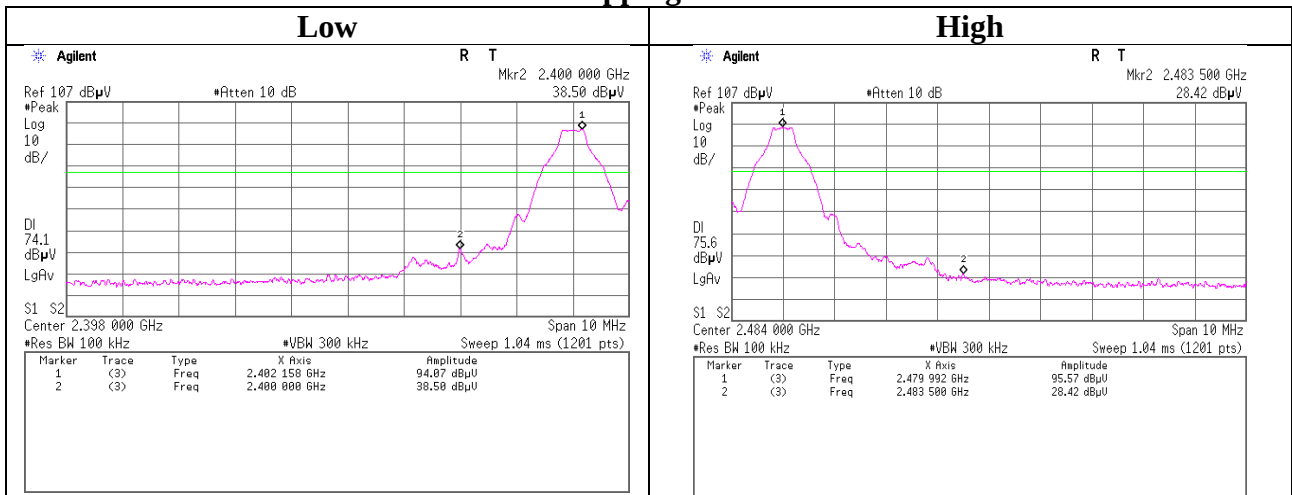
Conducted Emission Band Edge compliance

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11006397H
Date	October 27, 2015
Temperature / Humidity	23 deg. C / 57 % RH
Engineer	Ken Fujita
Mode	Tx DH5

Hopping On



Hopping Off



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Ise EMC Lab.

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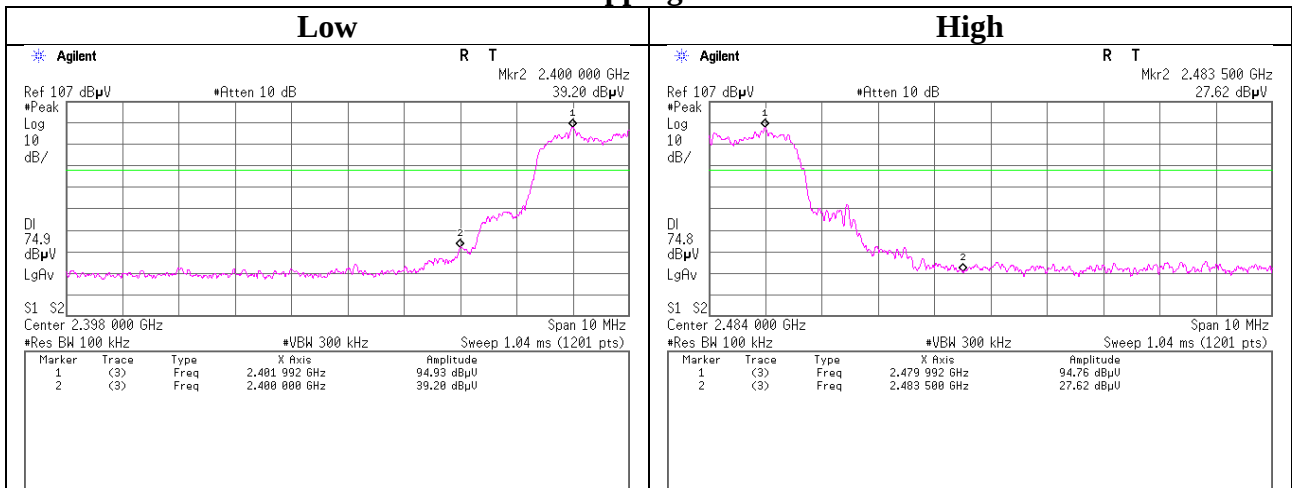
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

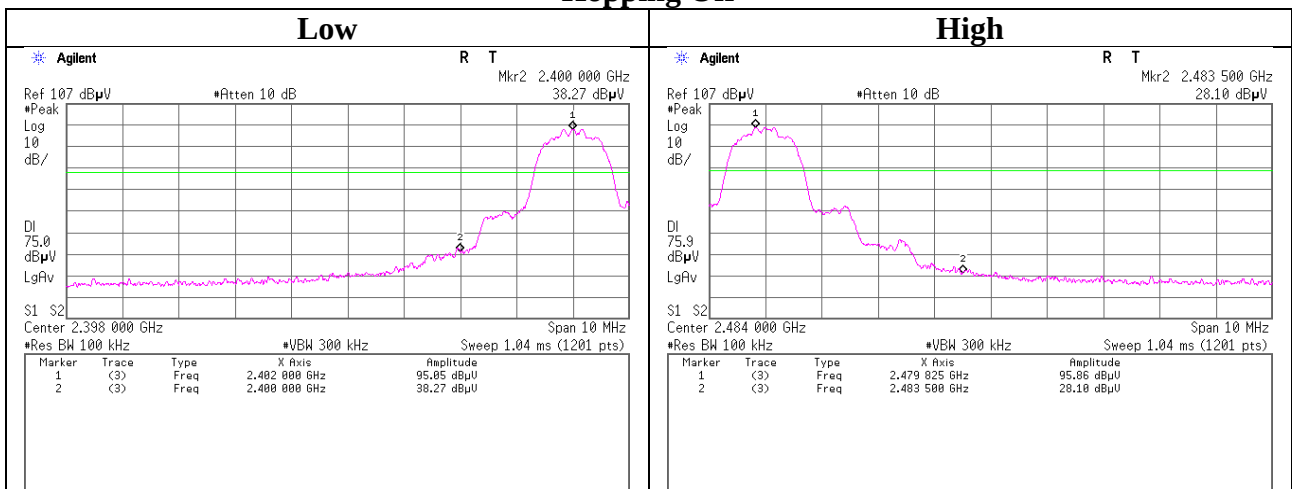
Conducted Emission Band Edge compliance

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11006397H
Date	October 27, 2015
Temperature / Humidity	23 deg. C / 57 % RH
Engineer	Ken Fujita
Mode	Tx 3DH5

Hopping On



Hopping Off



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Telephone : +81 596 24 8999

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99% Occupied Bandwidth

Test place

Report No.

Date

Temperature / Humidity

Engineer

Mode

Ise EMC Lab. No.11 Measurement Room

11006397H

October 27, 2015

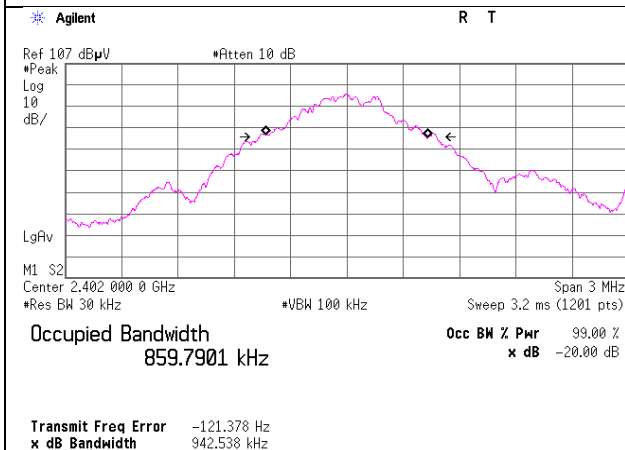
23 deg. C / 57 % RH

Ken Fujita

Tx Hopping Off

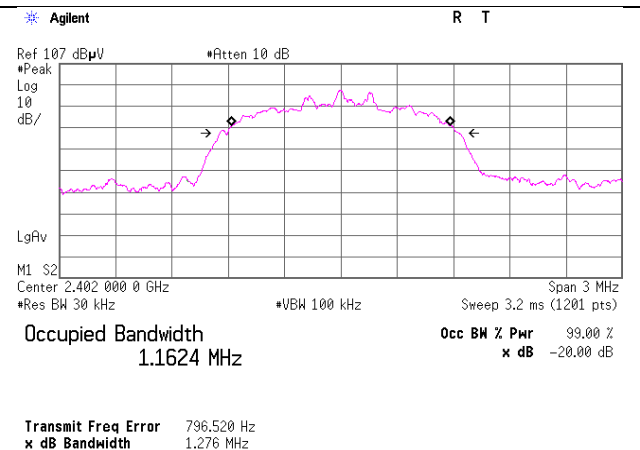
Hopping Off, DH5

2402 MHz

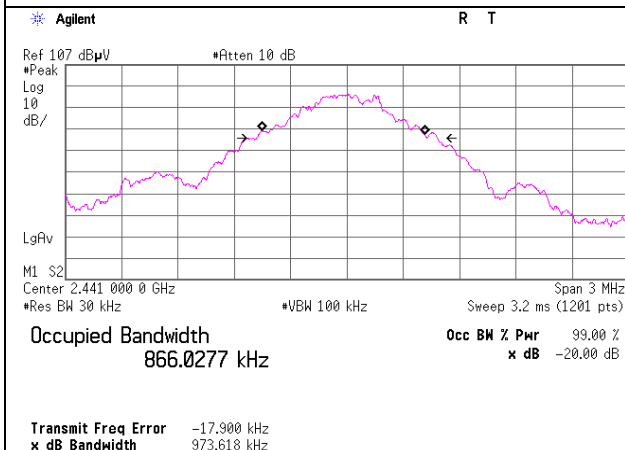


Hopping Off, 3DH5

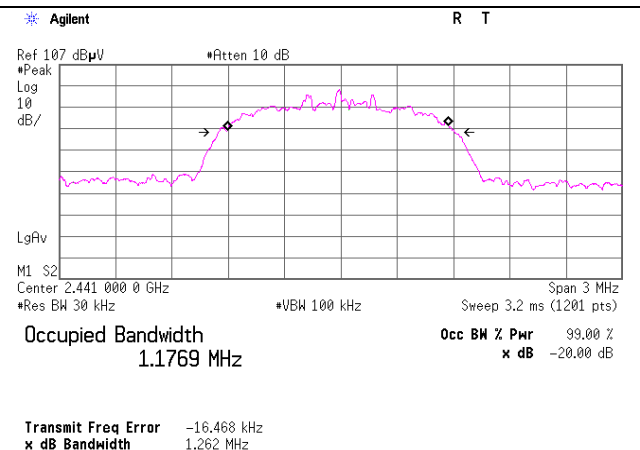
2402 MHz



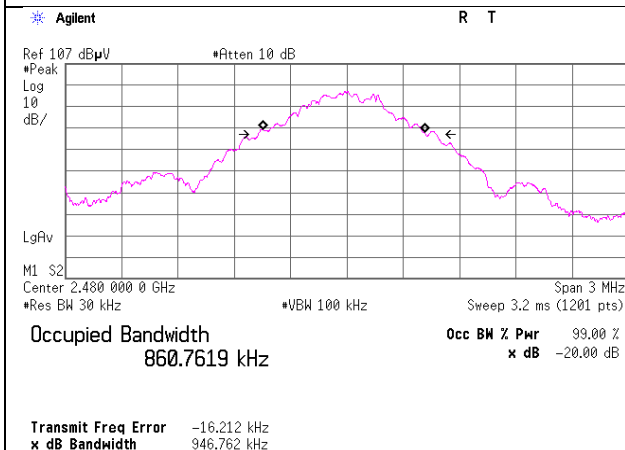
2441 MHz



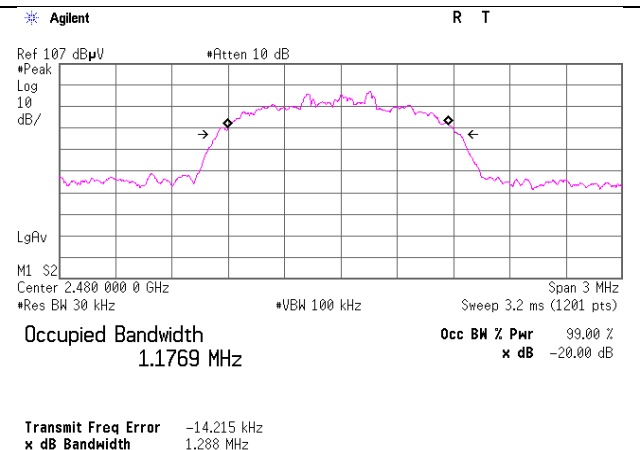
2441 MHz



2480 MHz



2480 MHz



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Ise EMC Lab.

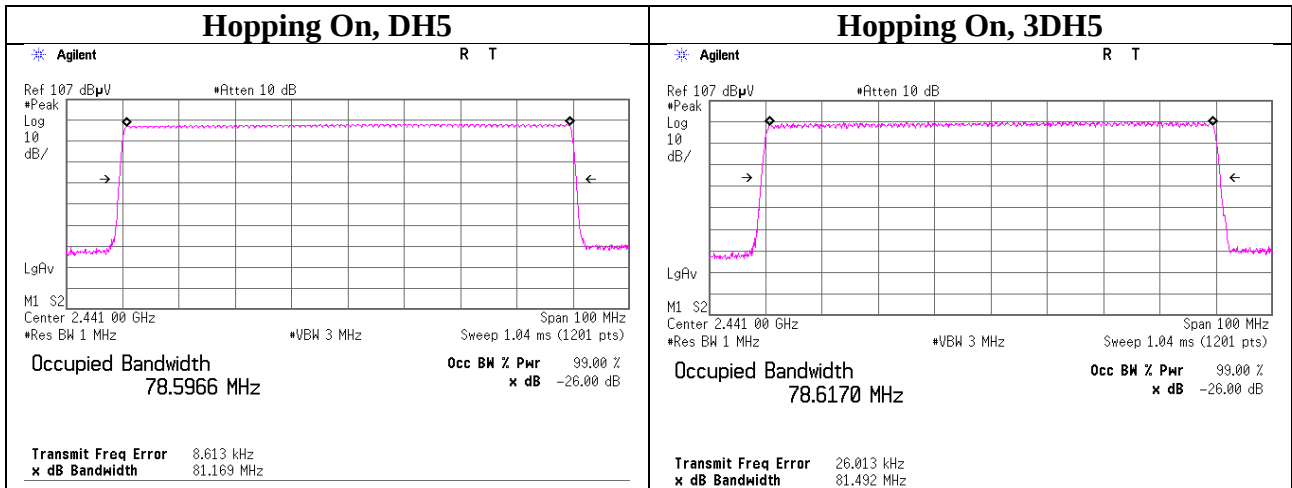
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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

99% Occupied Bandwidth

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11006397H
Date	October 27, 2015
Temperature / Humidity	23 deg. C / 57 % RH
Engineer	Ken Fujita
Mode	Tx Hopping On



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APPENDIX 2: Test instruments

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	2015/10/02 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	1501	RE	2015/01/13 * 12
MJM-23	Measure	ASKUL	-	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	RE	2014/11/12 * 12
MHA-21	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	RE	2015/08/10 * 12
MCC-141	Microwave Cable	Junkosha	MWX221	1305S002R(1m) / 1405S146(5m)	RE	2015/06/22 * 12
MPA-12	MicroWave System Amplifier	Agilent	83017A	00650	RE	2015/10/01 * 12
MHA-17	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170307	RE	2015/06/06 * 12
MMM-10	DIGITAL HiTESTER	Hioki	3805	051201148	RE	2015/01/16 * 12
MHF-26	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	002	RE	2015/09/17 * 12
MAT-57	Attenuator(10dB)	Suhner	6810.19.A	-	AT	2015/01/08 * 12
MCC-171	Microwave Cable	Junkosha	MWX221	1409S494	AT	2015/03/04 * 12
MSA-16	Spectrum Analyzer	Agilent	E4440A	MY46186390	AT	2015/02/16 * 12
MPSE-18	Power sensor	Anritsu	MA2411B	0738174	AT	2014/11/11 * 12
MOS-19	Thermo-Hygrometer	Custom	CTH-201	0001	AT	2014/12/22 * 12
MTR-01	Test Receiver	Rohde & Schwarz	ES140	100084	RE	2014/11/10 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2015/11/02 * 12
MLA-08	Logperiodic Antenna	Schwarzbeck	UKLP9140-A	N/A	RE	2015/11/03 * 12
MCC-50	Coaxial Cable	UL Japan	-	-	RE	2015/06/19 * 12
MAT-68	Attenuator	Anritsu	MP721B	6200961025	RE	2014/11/11 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2015/03/09 * 12
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2015/10/01 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	RE	2015/01/13 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE	-
MSA-15	Spectrum Analyzer	Agilent	E4440A	MY46187105	RE	2014/11/11 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE	2015/09/02 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2015/10/11 * 12
MLA-03	Logperiodic Antenna	Schwarzbeck	USLP9143	174	RE	2015/10/11 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2015/07/13 * 12
MAT-70	Attenuator(6dB)	Agilent	8491A-006	MY52460153	RE	2015/04/08 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2015/03/10 * 12
MMM-08	DIGITAL HiTESTER	Hioki	3805	051201197	RE	2015/01/16 * 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.

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: RE: Radiated Emission test
AT: Antenna Terminal Conducted test

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