



RADIO TEST REPORT

Test Report No. : 10549329A-G-R3

Applicant : CASIO COMPUTER CO., LTD.
Type of Equipment : Bluetooth Watch
Model No. : ECB-500
FCC ID : BBQS01W
Test regulation : FCC Part 15 Subpart C: 2014
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 any agency of the Federal Government.
6. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
7. This report is a revised version of 10549329A-G-R2. 10549329A-G-R2 is replaced with this report.

Date of test: November 12, 18, 2014

Tested by:

Kazuhiro Ando
EMC/Wireless Group,
Consumer Technology Division

Approved by:

Go Ishiwata
Site Manager
Engineer of EMC/Wireless Group,
Consumer Technology Division



TESTING
CERTIFICATE 1266.01

- ☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
☒ There is no testing item of "Non-accreditation".

UL Japan, Inc.

Kashima EMC Lab.

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13-EM-F0429

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REVISION HISTORY

Original Test Report No. 10549329A-G

Revision	Date	Page revised	Revision Description
00	December 1, 2014	-	Original
01	January 20, 2015	P.3 P.7 P.9 P.10 All pages	- Correction of clock frequencies used in the EUT in 2.2 Product description - Correction of Model and Serial number in 4.2 Description of EUT and support equipment - Modification of 9.4, Test procedure - Correction of Figure 1., Antenna angle - Due to change of company name, the description of "UL Kashima, Inc" was changed to "UL Japan, Inc".
02	January 28, 2015	P.3 P.4 P.7	- Due to change of block diagram, the description in FCC 15.31(e) of the stable voltage was changed. - Correction of typo in 3.2 Procedures and results - Correction of configuration in 4.2 Configuration and peripherals
03	January 28, 2015	P.7	- Addition of notation in the configuration in 4.2 Configuration and peripherals

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SECTION 1: Customer information

Company Name	: CASIO COMPUTER CO., LTD.
Brand Name	: CASIO
Address	: 3-2-1, Sakae-cho, Hamura-shi, Tokyo, 205-8555, JAPAN
Telephone Number	: +81-42-579-7282
Facsimile Number	: +81-42-579-7702
Contact Person	: Hiroaki Suzuki

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

2.1 Identification of E.U.T.

Type of equipment	: Bluetooth Watch
Model No.	: ECB-500
Serial No.	: Refer to 4.2 in this report.
Rating	: DC 2.5V
Country of Mass-production	: China
Condition of EUT	: Engineering prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	: No modification by the test lab.
Receipt Date of Sample	: November 12, 2014

2.2 Product description

Model: ECB-500 (referred to as the EUT in this report) is a Bluetooth Watch.
The clock frequencies used in the EUT: 26 MHz, 32.768 kHz

<Radio part>

Equipment type	: Transceiver
Frequency of operation	: 2402-2480MHz
Bandwidth & channel spacing	: 2MHz
Type of modulation	: GFSK
Antenna type	: Chip antenna
Antenna gain	: -1.0dBi
Operation temperature range	: -10 to +60 deg.C.

FCC 15.31 (e)

The EUT provides stable voltage (DC1.35V) 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 15.203

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

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2014, final revised on August 15, 2014 and effective October 14, 2014

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.209 Radiated emission limits, general requirements
Section 15.247 Operation within the bands 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz

3.2 Procedures and results

Item	Test Procedure *1)	Specification	Remarks	Deviation	Worst Margin	Results
Conducted Emission	ANSI C63.10:2009	FCC 15.207	-	N/A *2)	N/A	N/A
6dB Bandwidth	ANSI C63.10:2009	FCC 15.247 (a)(2)	Conducted	N/A	* See data	Complied
Maximum Peak Conducted Output Power	ANSI C63.10:2009	FCC 15.247 (b)(3)	Conducted	N/A		Complied
Out of Band Emission & Restricted Band Edges	ANSI C63.10:2009	FCC 15.109, 15.247 (d) & 15.209	Conducted / Radiated	N/A	3.8 dB Freq.: 7206.000MHz Polarization: Horizontal Detection:AV Mode: Tx 2402 MHz, Tx, Bluetooth LE	Complied
Maximum Power Spectral Density	ANSI C63.10:2009	FCC 15.247 (e)	Conducted	N/A	* See data	Complied

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

*1) These tests were also referred to KDB 558074 v03r02 (FCC), "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

*2) The test is not applicable since the EUT has no AC mains.

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3.3 Addition to standard

Item	Test Procedure	Specification	Remarks	Worst Margin	Results
Occupied Bandwidth (99%)	ANSI C63.4:2009 13. Measurement of intentional radiators, RSS-Gen 4.6.1	-	Conducted	-	-
Note: UL Japan's Work Procedures No. 13-EM-W0420 and 13-EM-W0422					

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

3.4 Confirmation

UL Japan, Inc. hereby confirms the E.U.T., in the configuration tested, complies with the specifications FCC Part 15 Subpart C: 2014.

3.5 Uncertainty

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

Item	Frequency range	
Radiated emission	30 MHz-1GHz	6.3 dB
	1 GHz-6 GHz	4.5 dB
	6 GHz-18 GHz	4.8 dB
	18 GHz-26.5 GHz	4.9 dB

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

Antenna port conducted test

Power measurement uncertainty above 1GHz for this test was: (±) 1.5dB

Spurious emission (Conducted) measurement (below 1GHz) uncertainty for this test was: (±) 1.6dB

Spurious emission (Conducted) measurement (1G-3GHz) uncertainty for this test was: (±) 1.4dB

Spurious emission (Conducted) measurement (3G-18GHz) uncertainty for this test was: (±) 2.8dB

Spurious emission (Conducted) measurement (18G-26.5GHz) uncertainty for this test was: (±) 2.5dB

Bandwidth measurement uncertainty for this test was: (±) 5.4%

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3.6 Test Location

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Facsimile number : +81 478 82 3373
A2LA Accreditation No. : 1266-01

	FCC Registration No.	IC Registration No.	Width x Depth x Height (m)	Size of reference ground plane/horizontal conducting plane (m)	Maximum measurement distance
No.1 Open site	90558	IC 4659A-1	6.0 x 5.5 x 2.5	20 x 40	10 m
No.2 Open site	510504	IC 4659A-2	4.4 x 4.4 x 2.15	18 x 20	10 m
No.5 Open site	99356	IC 4659A-5	8.6 x 7.1 x 2.4	18 x 23	10 m
No.1 Shielded room	90558	IC 4659A-1	5.4 x 4.5 x 2.3	-	-
No.2 Shielded room	510504	IC 4659A-2	3.6 x 2.7 x 2.3	-	-
No.3 Shielded room	-	-	5.4 x 3.6 x 2.3	-	-
No.4 Shielded Room	-	-	6.1 x 6.1 x 3.1	-	-
No.5 Shielded Room	99356	IC 4659A-5	4.2 x 3.1 x 2.5	-	-
No.3 Fully Anechoic Chamber	-	-	7.0 x 3.5 x 3.5	-	-
No.6 Semi-anechoic Chamber	372431	IC 4659A-6	8.5 x 5.5 x 5.2	-	3 m
No.10 Semi-anechoic Chamber	682397	IC 4659A-10	18.4 x 9.9 x 7.7	-	10 m
No.11 Semi-anechoic Chamber	718605	IC 4659A-7	9.0 x 6.5 x 5.2	-	3 m
No.1 Measurement room	-	-	5.0 x 3.7 x 2.6	-	-
No.6 Measurement room	-	-	4.3 x 4.4 x 2.7	-	-

Our company name was changed from “UL Kashima, Inc.” to “UL Japan, Inc.” on January 1st, 2015.

3.7 Data of tests, Test instruments, and Photographs of test set up

Refer to APPENDIX.

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

4.1 Operating mode

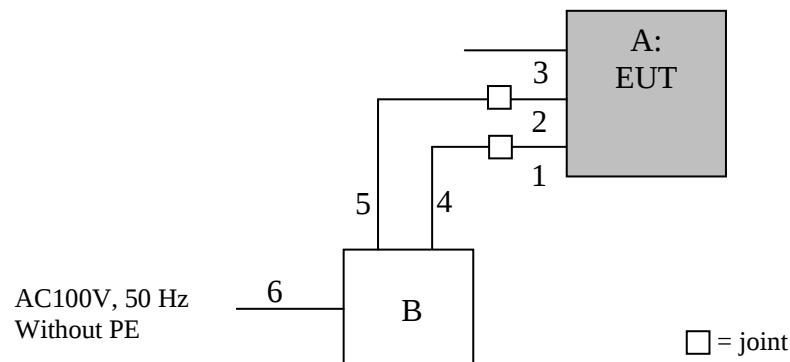
Test item	Mode	Tested frequency
All items	Transmitting Hopping OFF (Low Energy), Payload: PRBS9	2402MHz, 2440MHz, 2480MHz

Power settings: -6dBm

Test software: BACI Direct test over SPI

Justification: The system was configured in typical fashion (as customer would normally use it) for testing.

4.2 Configuration and peripherals



*Cabling and setup 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	Remark
A	Bluetooth Watch	ECB-500	*1)	CASIO	EUT
B	DC Power Source	PAD 35-10L	15314224	KIKUSUI ELETRINIS CORP.	

*1) Serial No.7 for Antenna port conducted tests, Serial No.6 for Radiated emission test.

List of cable used

No.	Item	Length (m)	Shield	Remark
1	DC(+)	0.1	Unshielded	Red
2	DC(-)	0.1	Unshielded	Black
3	Reset	0.1	Unshielded	White
4	DC(+) Extension	1.9	Unshielded	Dark blue
5	DC(-) Extension	1.9	Unshielded	Light blue
6	AC	2.8	Unshielded	

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SECTION 5: 6dB bandwidth & Occupied bandwidth (99%)

Test procedure

The bandwidth was measured with a spectrum analyzer connected to the antenna port.
The test was measured based on Method 8.1 Option 1 and 8.2 Option 2 of KDB 558074 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

Summary of the test results: Pass
Refer to APPENDIX 1

SECTION 6: Maximum peak output power

Test procedure

The Maximum Peak Output Power was measured with a power meter connected to the antenna port.
The test was measured based on Method 9.1.3 PKPM1 of KDB 558074 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

Summary of the test results: Pass
Refer to APPENDIX 1

SECTION 7: Spurious emissions (Antenna port conducted)

Test procedure

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

Summary of the test results: Pass
Refer to APPENDIX 1.

SECTION 8: Peak power density

Test procedure

The peak power density was measured with a spectrum analyzer connected to the antenna port.

Instrument used	:	Spectrum Analyzer
RBW / VBW	:	3kHz / 9kHz

The test was measured based on Method 10.2 PKPSD of KDB 558074 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

Summary of the test results: Pass
Refer to APPENDIX 1

SECTION 9: Radiated emission

9.1 Operating environment

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

9.2 Test configuration

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

9.3 Test conditions

Frequency range : 30MHz - 25GHz
 EUT position : Table top

9.4 Test procedure

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

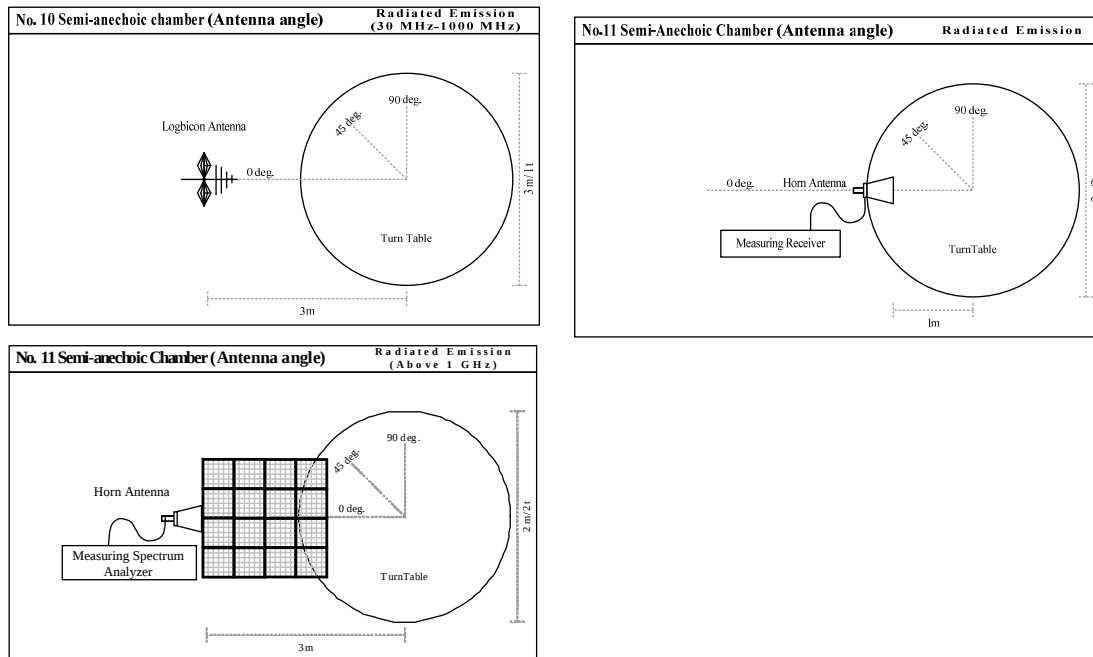
The radiated emission measurements were made with the following detection.

Frequency	30 - 1000MHz	1 - 25GHz	20dBc
Detection Type	: Quasi-Peak	Peak	Average *1)
IF Bandwidth	: 120kHz	RBW:1MHz	RBW: 1MHz
		VBW:3MHz	VBW: 3MHz
			Detector: Linear Voltage
			Averaging

*1) Average Power Measurement was measured based on 13. 3. 2. 1) 2) of "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

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

Figure 1. Antenna angle



9.5 Band edge

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

9.6 Results

Summary of the test results: Pass

*No noise was detected above the 4th order harmonics.

Refer to APPENDIX 1.

Contents of APPENDIXES

APPENDIX 1: Data of Radio tests

6dB bandwidth
Maximum peak output power
Radiated emission
Spurious emission (Antenna port conducted)
Peak power density
Occupied bandwidth

APPENDIX 2: Test instruments

Test instruments

APPENDIX 3: Photographs of test setup

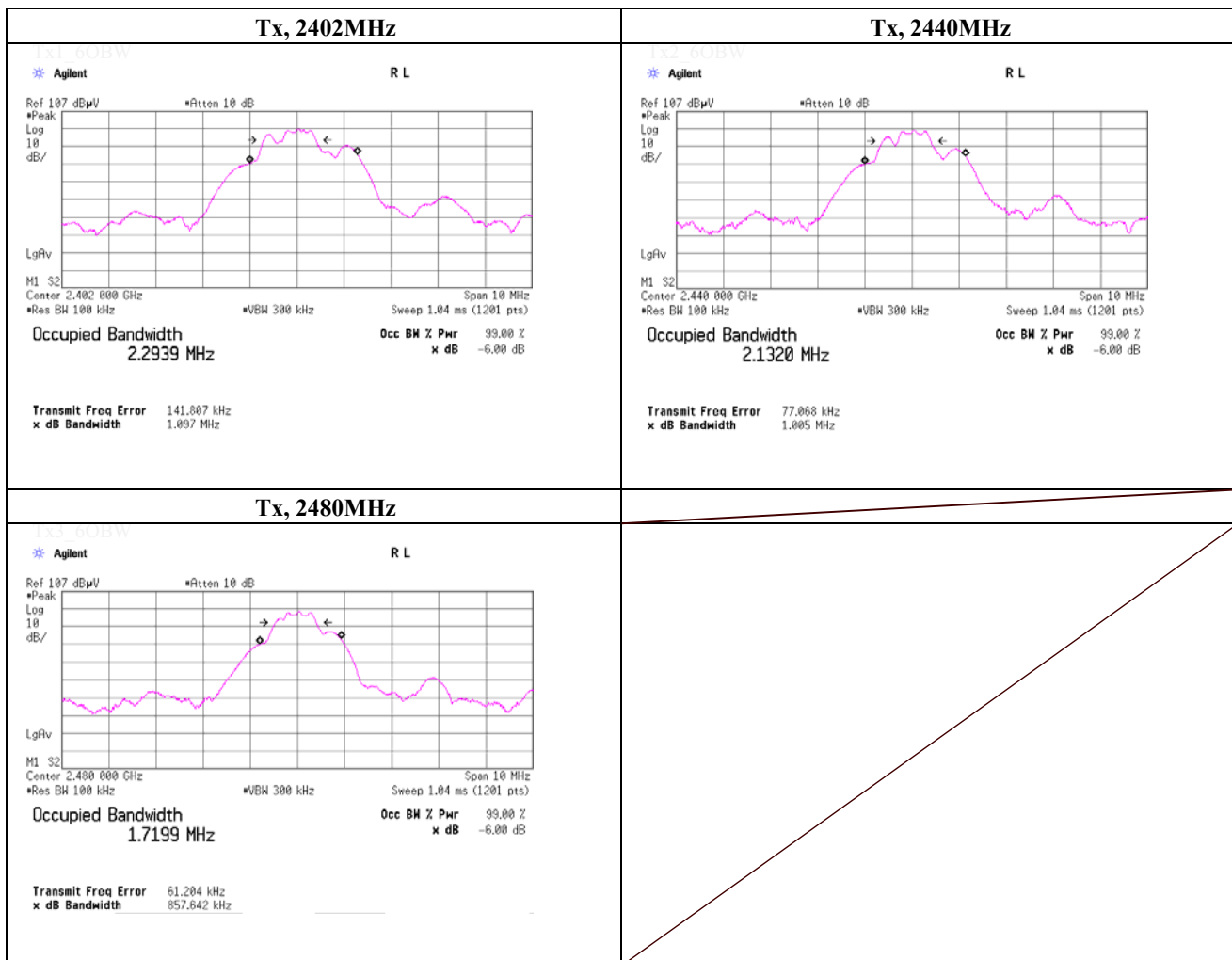
Radiated emission
Pre-check of the worst position

APPENDIX 1: Data of EMI test

-6dB Bandwidth

Test place	UL Japan, Inc.	No.6 Measurement Room
Date	November 12, 2014	
Temperature / Humidity	23deg.C , 56%RH	
Engineer	Kazuhiro Ando	
Mode	Tx, Bluetooth LE	

Freq. [MHz]	-6dB Bandwidth [MHz]	Limit [MHz]
2402.0000	1.097	> 0.500
2440.0000	1.005	> 0.500
2480.0000	0.858	> 0.500



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Maximum Peak Conducted Output Power

(PKPM1)

Test place	UL Japan, Inc.	No.6 Measurement Room
Date	November 18, 2014	
Temperature / Humidity	22deg.C , 40%RH	
Engineer	Kazuhiro Ando	
Mode	Tx, Bluetooth LE	

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

Ch	Freq.	P/M (Peak) Reading	Cable Loss	Atten. Loss	Result		Limit		Margin
	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
Low	2402.0	-14.13	0.67	10.07	-3.39	0.46	30.00	1000	33.39
Mid	2440.0	-14.22	0.68	10.07	-3.47	0.45	30.00	1000	33.47
High	2480.0	-14.63	0.68	10.07	-3.88	0.41	30.00	1000	33.88

Sample Calculation:

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

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Maximum Conducted Output Power (Reference data for SAR test)
(AVPM1)

Test place UL Japan, Inc. No.6 Measurement Room
Date November 18, 2014
Temperature / Humidity 22deg.C , 40%RH
Engineer Kazuhiro Ando
Mode Tx, Bluetooth LE

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

Ch	Freq.	P/M (AV) Reading	Cable Loss	Atten. Loss	Result	
	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]
Low	2402.0	-15.10	0.67	10.07	-4.36	0.37
Mid	2440.0	-15.24	0.68	10.07	-4.49	0.36
High	2480.0	-15.70	0.68	10.07	-4.95	0.32

Sample Calculation:

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

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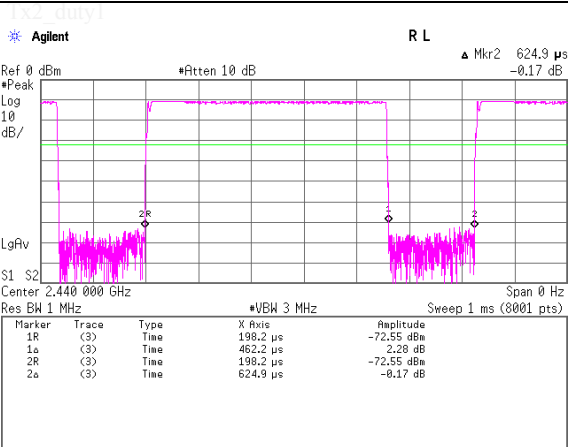
Burst rate confirmation

Tx, Bluetooth LE

Duty Factor Calculation

Duty Factor: $20\log(1/\text{duty cycle}) = 2.6\text{dB}$

duty cycle = $0.00046225 / 0.000624875 = 0.74 (74\%)$



tx2_duty2

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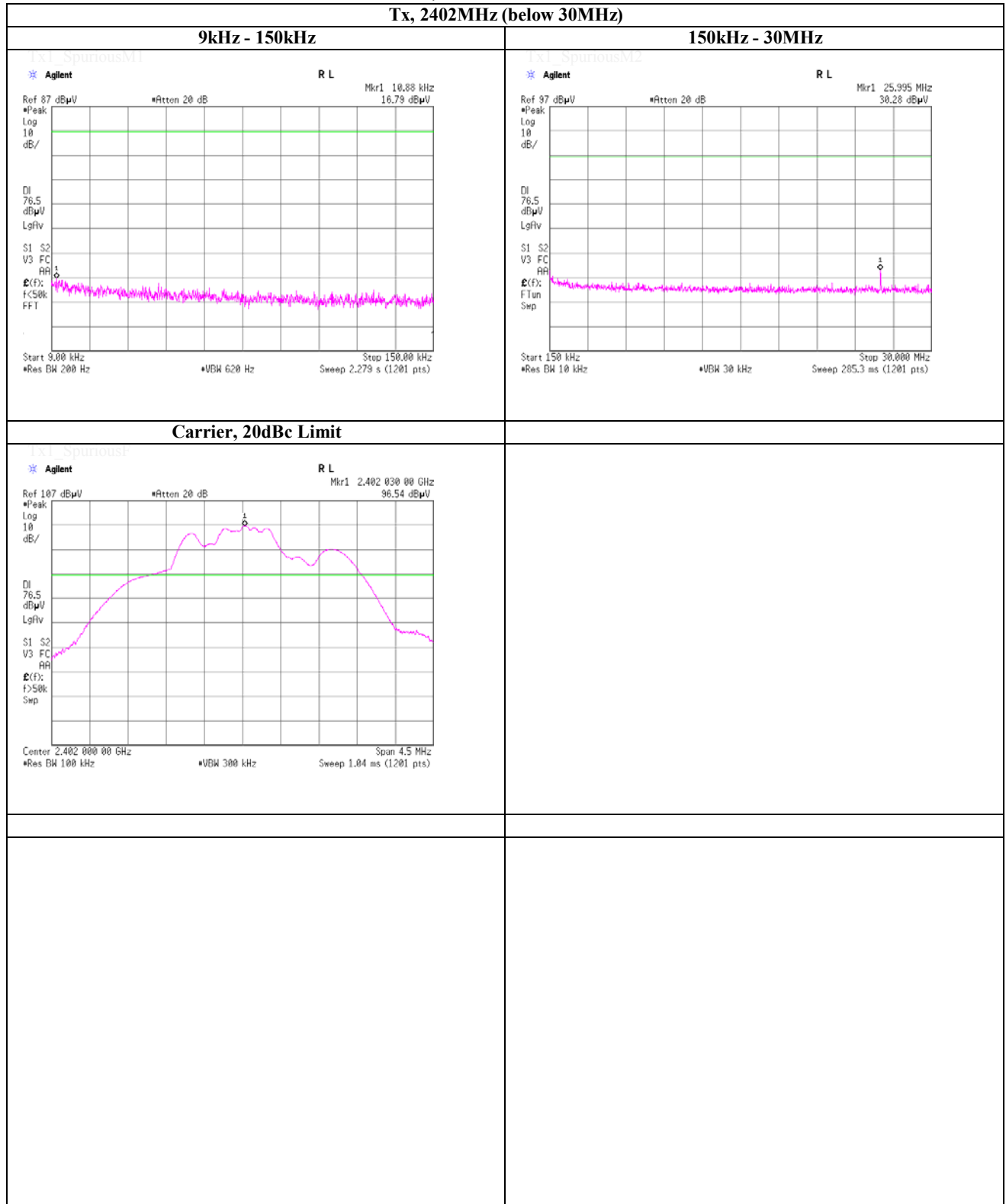
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Spurious emission (Conducted)

Tx, Bluetooth LE

Tx, 2402MHz (below 30MHz)



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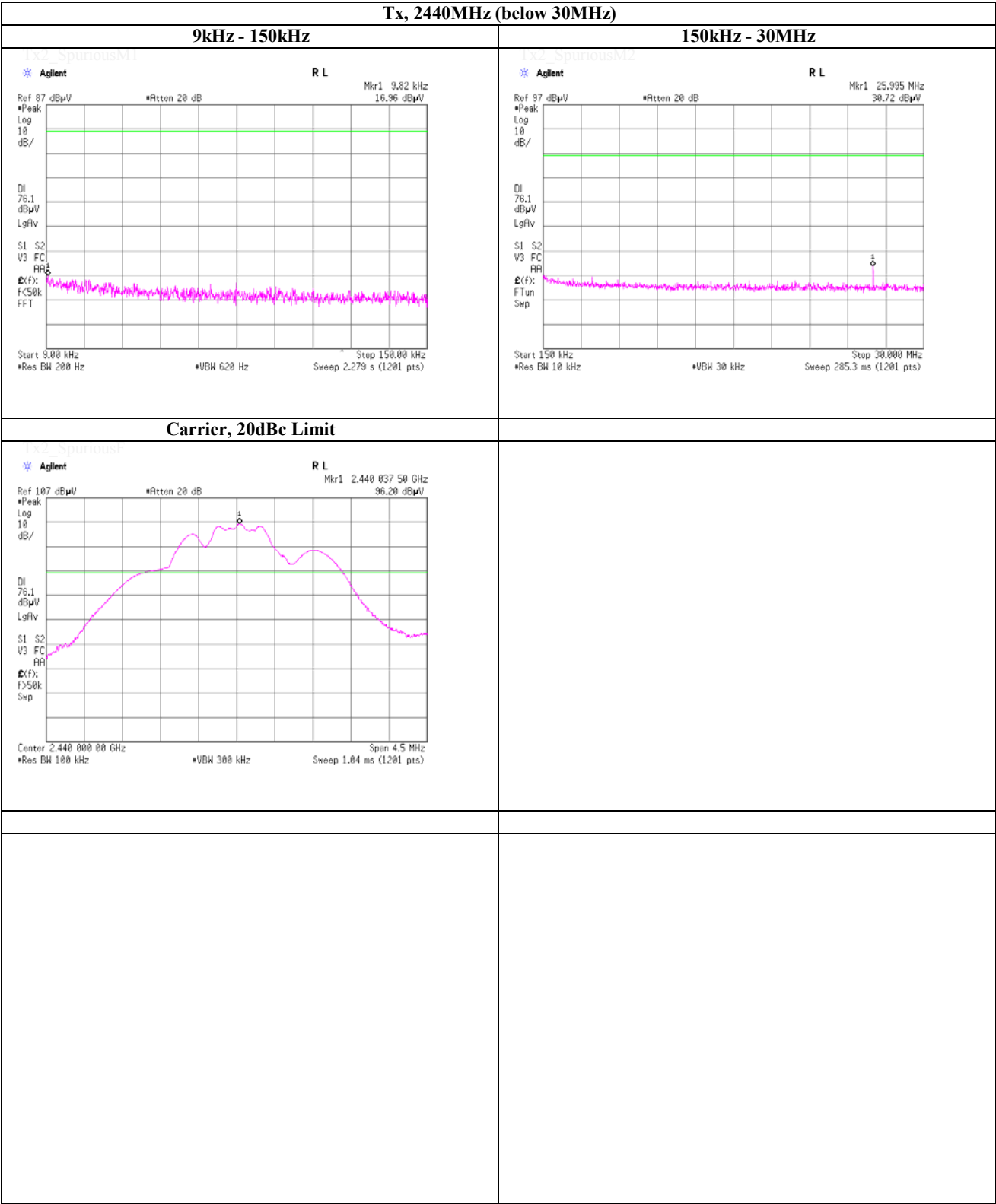
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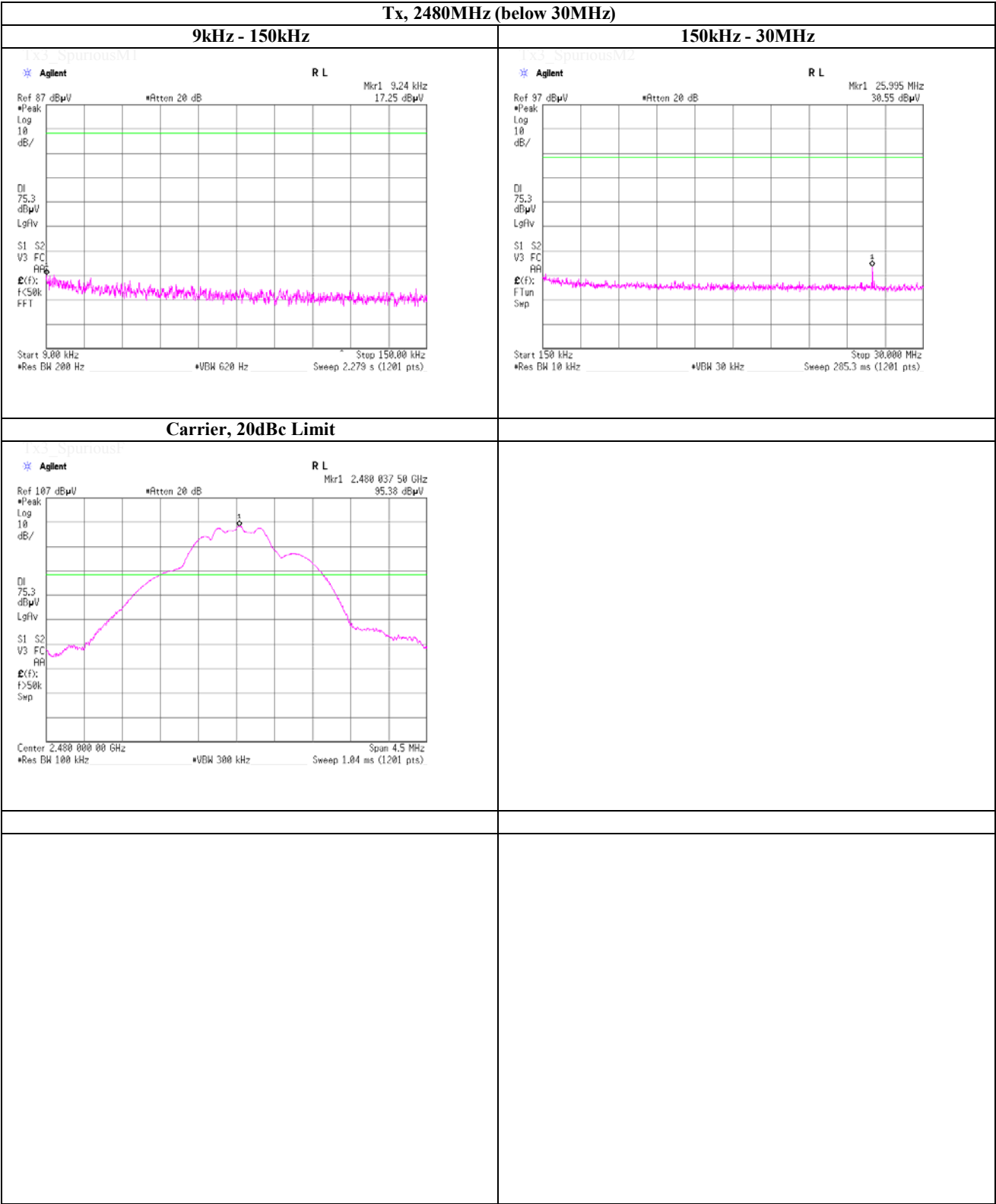
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Spurious emission (Conducted)
Tx, Bluetooth LE



Spurious emission (Conducted)
Tx, Bluetooth LE



Maximum Power Spectral Density

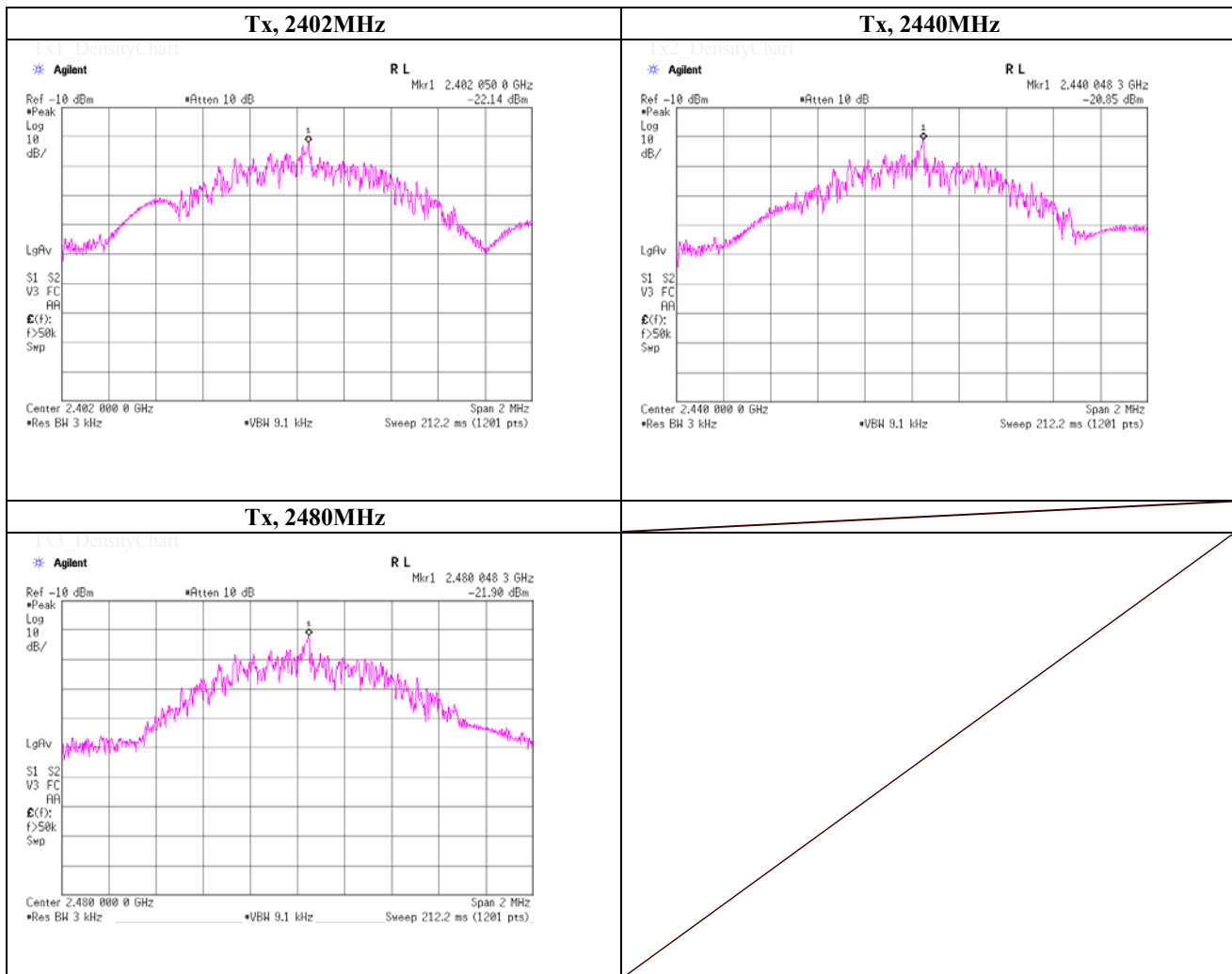
(PKPSD)

Test place	UL Japan, Inc.	No.6 Measurement Room
Date	November 12, 2014	
Temperature / Humidity	23deg.C , 56%RH	
Engineer	Kazuhiro Ando	
Mode	Tx, Bluetooth LE	

Ch. Freq. [MHz]	Freq. Reading [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.0000	2402.05	-22.14	0.67	10.07	-11.40	8.00	19.40
2440.0000	2440.05	-20.85	0.68	10.07	-10.10	8.00	18.10
2480.0000	2480.05	-21.90	0.68	10.07	-11.15	8.00	19.15

Sample Calculation:

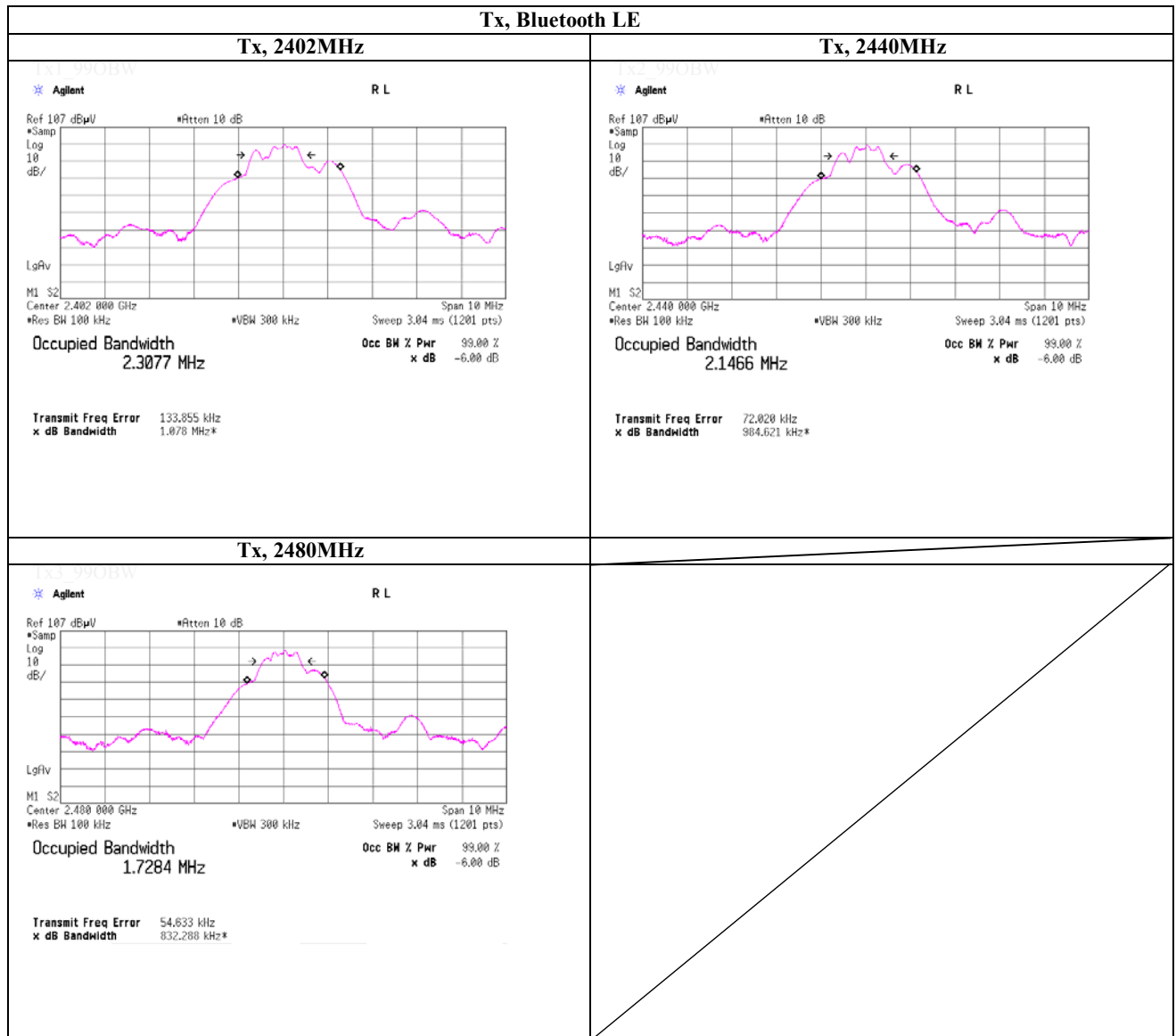
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss



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99% Occupied Bandwidth



Radiated Emission

Test place	No.10 Semi Anechoic Chamber(30-1000MHz)	No.11 Semi Anechoic Chamber(1-26.5GHz)
Date	November 12, 2014	November 18, 2014
Temperature / Humidity	23 deg.C, 42 %RH	23 deg.C, 48 %RH
Engineer	Tadashi Kuroda	Tadashi Kuroda
Mode	Tx, 2402 MHz	
	Tx, Bluetooth LE	

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	104.001	QP	20.4	9.5	5.3	26.7	8.5	43.5	35.0	300	165	
Hori.	286.003	QP	19.7	13.0	7.2	26.0	13.9	46.0	32.1	118	143	
Hori.	2390.000	PK	41.4	27.6	14.0	38.5	44.5	73.9	29.4	100	0	
Hori.	4804.000	PK	54.8	31.3	6.0	39.6	52.5	73.9	21.4	100	326	
Hori.	7206.000	PK	51.5	36.0	7.5	38.7	56.3	73.9	17.6	141	315	
Hori.	9608.000	PK	42.7	38.5	8.6	37.2	52.6	73.9	21.3	100	31	
Hori.	2390.000	AV	31.3	27.6	14.0	38.5	34.4	53.9	19.5	100	0	
Vert.	52.000	QP	25.2	13.6	4.6	26.8	16.6	40.0	23.4	100	222	
Vert.	78.000	QP	22.6	9.5	5.0	26.7	10.4	40.0	29.6	100	222	
Vert.	182.002	QP	19.2	11.7	6.2	26.3	10.8	43.5	32.7	100	222	
Vert.	234.003	QP	19.1	11.2	6.7	26.1	10.9	46.0	35.1	100	222	
Vert.	2390.000	PK	41.2	27.6	14.0	38.5	44.3	73.9	29.6	100	0	
Vert.	4804.000	PK	52.9	31.3	6.0	39.6	50.6	73.9	23.3	100	20	
Vert.	7206.000	PK	45.1	36.0	7.5	38.7	49.9	73.9	24.0	100	0	
Vert.	9608.000	PK	42.1	38.5	8.6	37.2	52.0	73.9	21.9	100	0	
Vert.	2390.000	AV	31.5	27.6	14.0	38.5	34.6	53.9	19.3	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+Attenuator+Filter)(below 18GHz)-Distance factor(above 13GHz)) - Gain(Amplifier)

Distance factor : 13GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4804.000	AV	47.8	31.3	6.0	39.6	2.6	48.1	53.9	5.8	
Hori.	7206.000	AV	42.7	36.0	7.5	38.7	2.6	50.1	53.9	3.8	
Hori.	9608.000	AV	30.9	38.5	8.6	37.2	2.6	43.4	53.9	10.5	
Vert.	4804.000	AV	45.9	31.3	6.0	39.6	2.6	46.2	53.9	7.7	
Vert.	7206.000	AV	32.9	36.0	7.5	38.7	2.6	40.3	53.9	13.6	
Vert.	9608.000	AV	30.0	38.5	8.6	37.2	2.6	42.5	53.9	11.4	

Result = Reading + Ant.Fac. + Loss (Cable+Attenuator+Filter)(below 18GHz)-Distance factor(above 13GHz)) - Gain(Amplifier) + Duty factor

Distance factor : 13GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	77.9	27.5	14.0	38.5	80.9	-	-	
Hori.	2400.000	PK	33.9	27.5	14.0	38.5	36.9	60.9	24.0	
Vert.	2402.000	PK	72.8	27.5	14.0	38.5	75.8	-	-	
Vert.	2400.000	PK	33.0	27.5	14.0	38.5	36.0	55.8	19.8	

Result = Reading + Ant.Fac. + Loss (Cable+Attenuator)(below 18GHz) - Gain(Amplifier)

Radiated Emission

Test place	No.10 Semi Anechoic Chamber(30-1000MHz)	No.11 Semi Anechoic Chamber(1-26.5GHz)
Date	November 12, 2014	November 18, 2014
Temperature / Humidity	23 deg.C, 42 %RH	23 deg.C, 48 %RH
Engineer	Tadashi Kuroda	Tadashi Kuroda
Mode	Tx, 2440 MHz	
	Tx, Bluetooth LE	

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	104.001	QP	20.6	9.5	5.3	26.7	8.7	43.5	34.8	300	147	
Hori.	286.003	QP	19.7	13.0	7.2	26.0	13.9	46.0	32.1	118	144	
Hori.	4880.000	PK	50.6	31.2	6.0	39.6	48.2	73.9	25.7	100	322	
Hori.	7320.000	PK	48.6	36.2	7.6	38.7	53.7	73.9	20.2	100	327	
Hori.	9760.000	PK	42.5	39.0	8.6	37.2	52.9	73.9	21.0	100	324	
Vert.	52.000	QP	25.6	13.6	4.6	26.8	17.0	40.0	23.0	100	189	
Vert.	78.001	QP	23.0	9.5	5.0	26.7	10.8	40.0	29.2	100	189	
Vert.	182.002	QP	19.2	11.7	6.2	26.3	10.8	43.5	32.7	100	220	
Vert.	234.002	QP	19.1	11.2	6.7	26.1	10.9	46.0	35.1	100	220	
Vert.	4880.000	PK	48.8	31.2	6.0	39.6	46.4	73.9	27.5	100	19	
Vert.	7320.000	PK	44.4	36.2	7.6	38.7	49.5	73.9	24.4	100	324	
Vert.	9760.000	PK	41.8	39.0	8.6	37.2	52.2	73.9	21.7	100	350	

Result = Reading + Ant.Fac. + Loss (Cable+Attenuator+Filter)(below 18GHz)-Distance factor(above 13GHz)) - Gain(Amplifier)

Distance factor : 13GHz -40GHz : $20\log(3.0\text{m}/1.0\text{m}) = 9.5\text{dB}$ **Average measurement value with duty factor**

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4880.000	AV	42.6	31.2	6.0	39.6	2.6	42.8	53.9	11.1	
Hori.	7320.000	AV	38.0	36.2	7.6	38.7	2.6	45.7	53.9	8.2	
Hori.	9760.000	AV	30.5	39.0	8.6	37.2	2.6	43.5	53.9	10.4	
Vert.	4880.000	AV	29.4	31.2	6.0	39.6	2.6	29.6	53.9	24.3	
Vert.	7320.000	AV	32.6	36.2	7.6	38.7	2.6	40.3	53.9	13.6	
Vert.	9760.000	AV	29.5	39.0	8.6	37.2	2.6	42.5	53.9	11.4	

Result = Reading + Ant.Fac. + Loss (Cable+Attenuator+Filter)(below 18GHz)-Distance factor(above 13GHz)) - Gain(Amplifier) + Duty factor

Distance factor : 13GHz -40GHz : $20\log(3.0\text{m}/1.0\text{m}) = 9.5\text{dB}$

Radiated Emission

Test place	No.10 Semi Anechoic Chamber(30-1000MHz)	No.11 Semi Anechoic Chamber(1-26.5GHz)
Date	November 12, 2014	November 18, 2014
Temperature / Humidity	23 deg.C, 42 %RH	23 deg.C, 48 %RH
Engineer	Tadashi Kuroda	Tadashi Kuroda
Mode	Tx, 2480 MHz	
	Tx, Bluetooth LE	

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	104.000	QP	20.5	9.5	5.3	26.7	8.6	43.5	34.9	297	148	
Hori.	286.003	QP	19.7	13.0	7.2	26.0	13.9	46.0	32.1	121	148	
Hori.	2483.500	PK	41.2	27.5	14.1	38.5	44.3	73.9	29.6	100	0	
Hori.	4960.000	PK	50.4	31.5	6.1	39.6	48.4	73.9	25.5	105	334	
Hori.	7440.000	PK	47.5	36.3	7.6	38.6	52.8	73.9	21.1	100	307	
Hori.	9920.000	PK	44.6	39.0	8.7	37.1	55.2	73.9	18.7	153	310	
Hori.	2483.500	AV	31.4	27.5	14.1	38.5	34.5	53.9	19.4	100	0	
Vert.	52.001	QP	25.2	13.6	4.6	26.8	16.6	40.0	23.4	100	208	
Vert.	78.001	QP	22.9	9.5	5.0	26.7	10.7	40.0	29.3	100	208	
Vert.	182.002	QP	19.3	11.7	6.2	26.3	10.9	43.5	32.6	100	239	
Vert.	234.002	QP	19.3	11.2	6.7	26.1	11.1	46.0	34.9	100	239	
Vert.	2483.500	PK	40.7	27.5	14.1	38.5	43.8	73.9	30.1	100	0	
Vert.	4960.000	PK	48.0	31.5	6.1	39.6	46.0	73.9	27.9	100	21	
Vert.	7440.000	PK	44.3	36.3	7.6	38.6	49.6	73.9	24.3	100	0	
Vert.	9920.000	PK	41.6	39.0	8.7	37.1	52.2	73.9	21.7	100	0	
Vert.	2483.500	AV	31.1	27.5	14.1	38.5	34.2	53.9	19.7	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+Attenuator+Filter)(below 18GHz)-Distance factor(above 13GHz)) - Gain(Amplifier)

Distance factor : 13GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4960.000	AV	41.3	31.5	6.1	39.6	2.6	41.9	53.9	12.0	
Hori.	7440.000	AV	36.6	36.3	7.6	38.6	2.6	44.5	53.9	9.4	
Hori.	9920.000	AV	33.1	39.0	8.7	37.1	2.6	46.3	53.9	7.6	
Vert.	4960.000	AV	37.7	31.5	6.1	39.6	2.6	38.3	53.9	15.6	
Vert.	7440.000	AV	31.7	36.3	7.6	38.6	2.6	39.6	53.9	14.3	
Vert.	9920.000	AV	29.6	39.0	8.7	37.1	2.6	42.8	53.9	11.1	

Result = Reading + Ant.Fac. + Loss (Cable+Attenuator+Filter)(below 18GHz)-Distance factor(above 13GHz)) - Gain(Amplifier) + Duty factor

Distance factor : 13GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

Appendix 2: Test instruments

No.10 Test site (Radiated emission: Below 1GHz)

Instrument	Manufacturer	Model	Internal Code	Cal. Date	Due Date
Test Receiver	Agilent	N9038A	RCV12	2014/06/06	2015/06/30
Logbicon Antenna	Schwarzbeck	VULB 9168	LGBC05	2013/11/05	2014/11/30
Pre-Amplifier	Hewlett Packard	8447D	PRA08	2014/08/27	2015/08/31
Coaxial Cable	Fujikura	5D-2W	10R3m	2014/08/27	2015/08/31
Test Software	TSJ	TEPTO-DV	Ver.2.5.0113	N/A	

No.11 Test site (Radiated emission: Above 1GHz)

Instrument	Manufacturer	Model	Internal Code	Cal. Date	Due Date
Spectrum Analyzer	Agilent	N9030A	SPR24	2014/05/20	2015/05/31
Horn Antenna	Schwarzbeck	BBHA9120D	MWH13	2014/07/12	2015/07/31
Horn Antenna	TOYO	DRH07	DRH07	2014/05/26	2015/05/31
Attenuator	Weinschel	54A-10	FAT72	2014/05/23	2015/05/31
Highpass Filter	Micro-Tronics	HPM50111-02	HPF03	2014/05/23	2015/05/31
Pre-Amplifier	TOYO	TPA0118-36	PRA18	2014/07/14	2015/07/31
Micro Wave Cable	Junkosha	MWX241	WLC05-1m	2014/05/23	2015/05/31
Micro Wave Cable	Junkosha	MWX221	WLC07-8m	2014/05/23	2015/05/31
Micro Wave Cable	SUHNER	SUCOFLEX104	WLC09-5.5m	2014/07/17	2015/07/31
Test Software	TSJ	TEPTO-DV	Ver.2.5.0113	N/A	

No.6 Measurement Room (Antenna terminal conducted test)

Instrument	Manufacturer	Model	Internal Code	Cal. Date	Due Date
Spectrum Analyzer	Agilent	E4448A	SPR25	2014/05/19	2015/05/31
Power Meter	Agilent	8990B	PWM18	2014/05/14	2015/05/31
Power Sensor	Agilent	N1923A	PWS33	2014/06/26	2015/06/30
Attenuator	Weinschel	54A-10	FAT73	2014/05/23	2015/05/31
Coaxial Cable	Junkosha	MWX241	WLC06-1m	2014/05/23	2015/05/31