Report on the RF Testing of:

KYOCERA Corporation
Mobile Phone, Model: EB1090
FCC ID: JOYEB1090

In accordance with FCC Part 15 Subpart C

Japan

Add value.
Inspire trust.

Prepared for: KYOCERA Corporation
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Document Number: JPD-TR-21154-0

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Hiroaki Suzuki	Deputy Manager of RF Group	Approved Signatory	2021.09.14

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Japan Ltd. document control rules.

EXECUTIVE SUMMARY – Result: Complied
A sample of this product was tested and the result above was confirmed in accordance with FCC Part 15 Subpart C.

ACCREDITED
Certificate #3686.03

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1 Summary of Test

1.1 Modification history of the test report

Document Number	Modification History	Issue Date
JPD-TR-21154-0	First Issue	Refer to the cover page

1.2 Standards

CFR47 FCC Part 15 Subpart C

1.3 Test methods

ANSI C63.10-2013,
KDB 558074 D01 15.247 Meas Guidance v05r02

1.4 Deviation from standards

None

1.5 List of applied test(s) of the EUT

Test item section	Test item	Condition	Result	Remark
15.247(a)(2)	6dB Bandwidth	Conducted	PASS	-
15.247(b)(3)	Maximum Peak Output Power	Conducted	PASS	-
15.247(d)	Band Edge Compliance of RF Conducted Emissions	Conducted	PASS	-
15.247(d) 15.205 15.209	Spurious Emissions	Conducted	PASS	-
		Radiated	PASS	-
15.247(d) 15.205 15.209	Restricted Bands of Operation	Radiated	PASS	-
15.247(e)	Transmitter Power Spectral Density	Conducted	PASS	-
15.207	AC Power Line Conducted Emissions	Conducted	PASS	-

1.6 Test information

None

1.7 Test set up

Table-top

1.8 Test period

26-July-2021 - 29-July-2021

Japan

2 Equipment Under Test

All information in this chapter was provided by the applicant.

2.1 EUT information

Applicant	KYOCERA Corporation
	Yokohama Office 2-1-1 Kagahara, Tsuzuki-ku Yokohama-shi, Kanagawa, Japan
	Phone: +81-45-943-6253 Fax: +81-45-943-6314
Equipment Under Test (EUT)	Mobile Phone
Model number	EB1090
Serial number	N/A
Trade name	Kyocera
Number of sample(s)	1
EUT condition	Pre-Production
Power rating	Battery: DC 3.80 V
Size	(W) 57.1 × (D) 25.4 × (H) 125.6 mm
Environment	Indoor and Outdoor use
Terminal limitation	-20 ˚C to 60 ˚C
Hardware version	DMT
Software version	0.140PR.0035.a
Firmware version	Not applicable
RF Specification	
Protocol	Bluetooth 4.2 + EDR
Frequency range	2402 MHz-2480 MHz
Number of RF Channels	40 Channels
Modulation method/Data rate	GFSK (1 Mbps)
Channel separation	2 MHz
Conducted power	3.954 mW
Antenna type	Internal antenna
Antenna gain	2.81 dBi

2.2 Modification to the EUT

The table below details modifications made to the EUT during the test project.

Modification State	Description of Modification	Modification fitted by	Date of Modification
Model: EB1090, Serial Number: N/A			
0	As supplied by the applicant	Not Applicable	Not Applicable

Japan

2.3 Variation of family model(s)

2.3.1 List of family model(s)

Not applicable

2.3.2 Reason for selection of EUT

Not applicable

2.4 Operating channels and frequencies

Channel	Frequency [MHz]	Channel	Frequency [MHz]
0	2402	20	2442
1	2404	21	2444
2	2406	22	2446
3	2408	23	2448
4	2410	24	2450
5	2412	25	2452
6	2414	26	2454
7	2416	27	2456
8	2418	28	2458
9	2420	29	2460
10	2422	30	2462
11	2424	31	2464
12	2426	32	2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
18	2438	38	2478
19	2440	39	2480

2.5 Operating mode

The EUT had been tested under operating condition.
There are three channels have been tested as following:

Tested Channel	Frequency [MHz]
Low	2402
Middle	2440
High	2480

The pre-test has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates.

Tested Channel	Modulation Type	Data Rate
Low, Middle, High	GFSK	1 Mbps

The field strength of spurious emissions was measured at each position of all three axis X, Y and Z to compare the level, and the maximum noise.
The worst emission was found in X-axis, Close and the worst case recorded.
Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports.

Japan

2.6 Operating flow

[Tx mode]
i) Test program setup to the Software
ii) Select a Test mode
Operating frequency: Channel Low: 2402 MHz, Channel Middle: 2440 MHz, Channel High: 2480 MHz
iii) Start test mode

[Rx mode]
i) Test program setup to the Software
ii) Select a Test mode
Operating frequency: Channel Low: 2402 MHz, Channel Middle: 2440 MHz, Channel High: 2480 MHz
iii) Start test mode

Japan

3 Configuration of Equipment

Numbers assigned to equipment on the diagram in “3.3 System configuration” correspond to the list in “3.1 Equipment used” and “3.2 Cable(s) used”.
Cabling and setup(s) were taken into consideration and test data was taken under worse case condition.

3.1 Equipment used

No.	Equipment	Company	Model No.	Serial No.	FCC ID/DoC	Comment
1	Mobile Phone	KYOCERA	EB1090	N/A	JOYEB1090	EUT
2	AC Adapter	KDDI	0301PQA	N/A	N/A	*

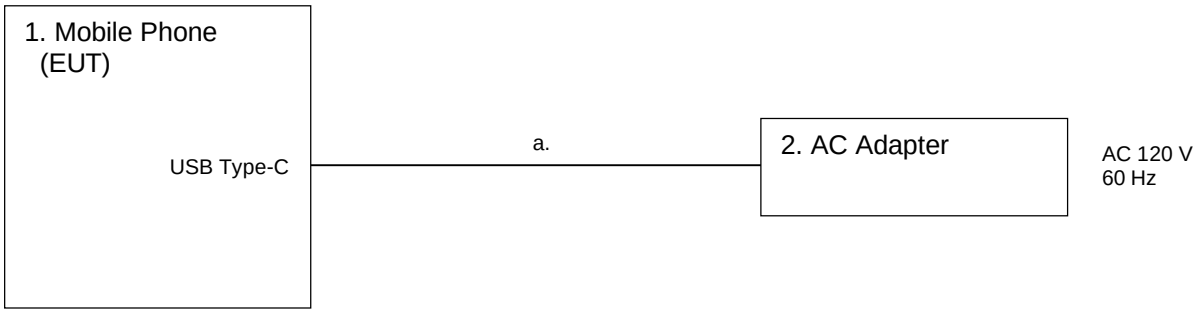
*:AC power line Conducted Emission Test.

3.2 Cable(s) used

No.	Equipment	Length[m]	Shield	Connector	Comment
a	USB cable (for AC Adapter)	1.0	Yes	Metal	*

*:AC power line Conducted Emission Test.

3.3 System configuration



Japan

4 Test Result

4.1 6dB Bandwidth / Occupied Bandwidth (99%)

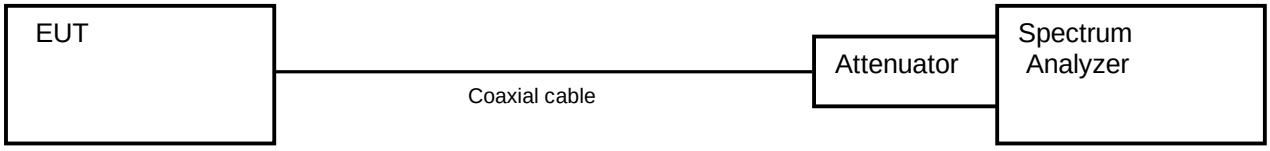
4.1.1 Measurement procedure

[FCC 15.247(a)(2), KDB558074 D01 v05r02]

The bandwidth at 6 dB down from the highest inband spectral density is measured with spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to;
a) RBW = 100 kHz
b) VBW ≥ 3 x RBW
c) Sweep time = auto-couple
d) Detector = peak
e) Trace mode = max hold

- Test configuration



4.1.2 Limit

The minimum permissible 6dB bandwidth is 500kHz.

4.1.3 Measurement result

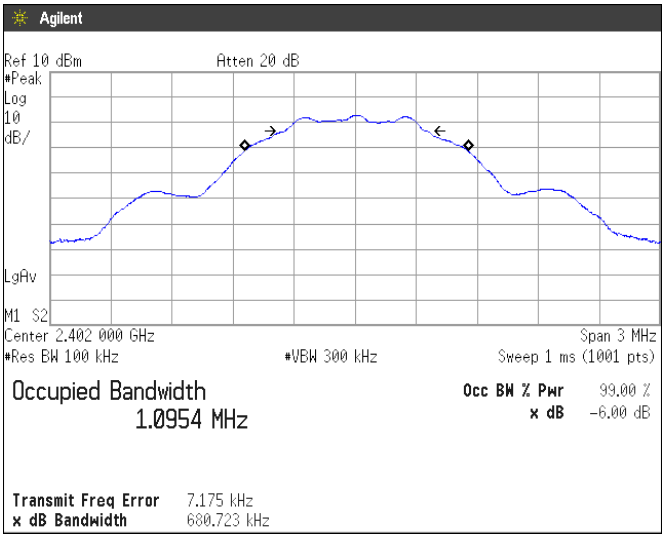
Date : 29-July-2021
Temperature : 23.1 [˚C]
Humidity : 64.1 [%]
Test place : Shielded room No.4

Test engineer : Chiaki Kanno

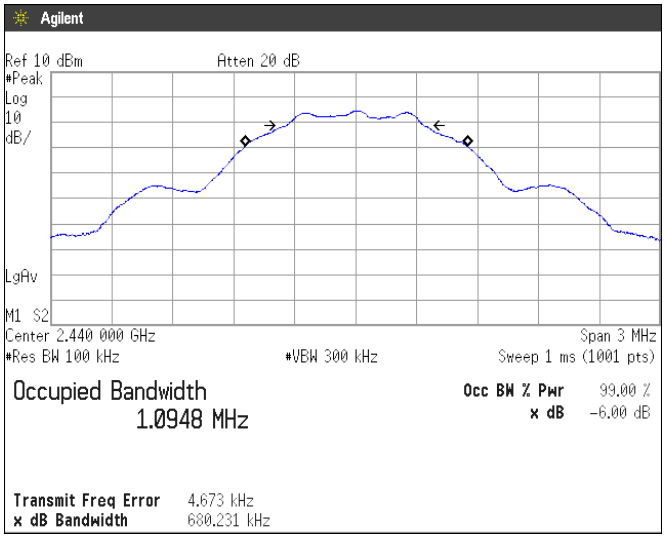
Channel	Frequency [MHz]	6 dB bandwidth [MHz]
Low	2402	0.681
Middle	2440	0.680
High	2480	0.678

4.1.4 Trace data

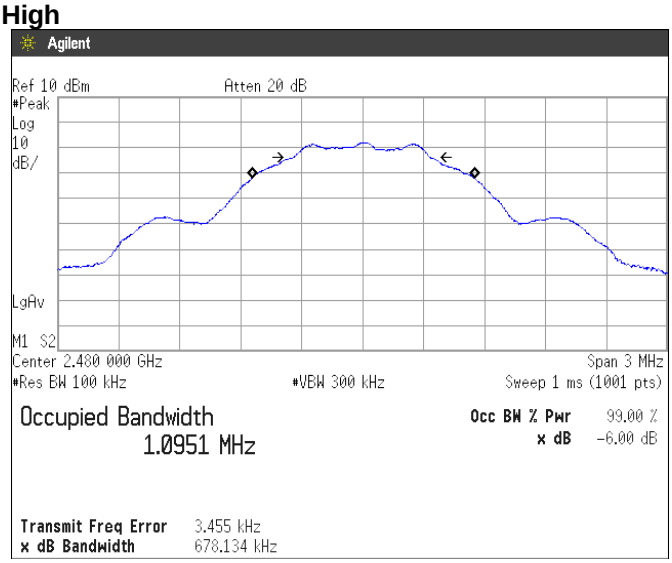
Channel Low



Channel Middle



Channel High



Japan

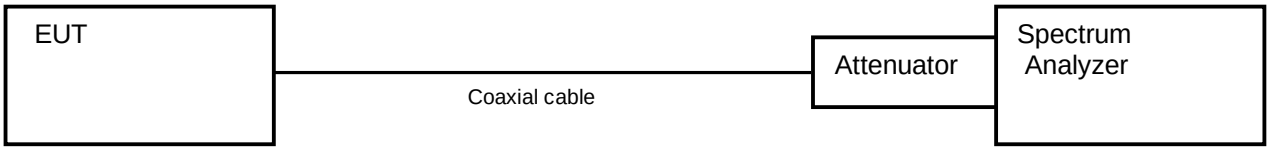
4.2 Maximum Peak Output Power

4.2.1 Measurement procedure

[FCC 15.247(b)(3), KDB558074 D01 v05r02]

The peak power is measured with a power sensor connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

- Test configuration



4.2.2 Limit

1 W(1000 mW) or less

4.2.3 Measurement result

Date : 29-July-2021
Temperature : 23.1 [˚C]
Humidity : 64.1 [%]
Test place : Shielded room No.4

Test engineer : Chiaki Kanno

Battery Full

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	10log(1/x) (dB)	Level (dBm)	Peak Output Power (mW)	Limit (mW)	Result
Low	2402	-6.27	10.49	4.22	2.642	-6.27	≦1000	PASS
Middle	2440	-4.52	10.49	5.97	3.954	-4.52	≦1000	PASS
High	2480	-7.03	10.49	3.46	2.218	-7.03	≦1000	PASS

Calculation;
Reading (dBm) + Factor (dB) = Level (dBm)
10logP = Level (dBm)
$P = 10^{(\text{Maximum Peak Output Power} / 10)}$ (mW)

Japan

4.3 Band Edge Compliance of RF Conducted Emissions

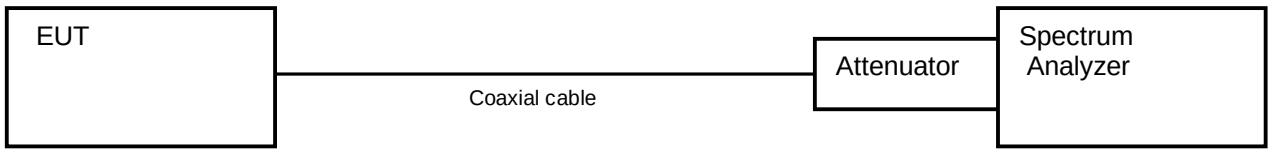
4.3.1 Measurement procedure

[FCC 15.247(d), KDB558074 D01 v05r02]

The Band Edge is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to;
a) Span = Arbitrary setting. (Setting suitable for measurement.)
b) RBW = 100 kHz
c) VBW ≥ 3 x RBW
d) Sweep time = auto-couple
e) Detector = peak
f) Trace mode = max hold

- Test configuration



4.3.2 Limit

In any 100kHz bandwidth outside the frequency band the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.

4.3.3 Measurement result

Date : 29-July-2021
Temperature : 23.1 [˚C]
Humidity : 64.1 [%]
Test place : Shielded room No.4

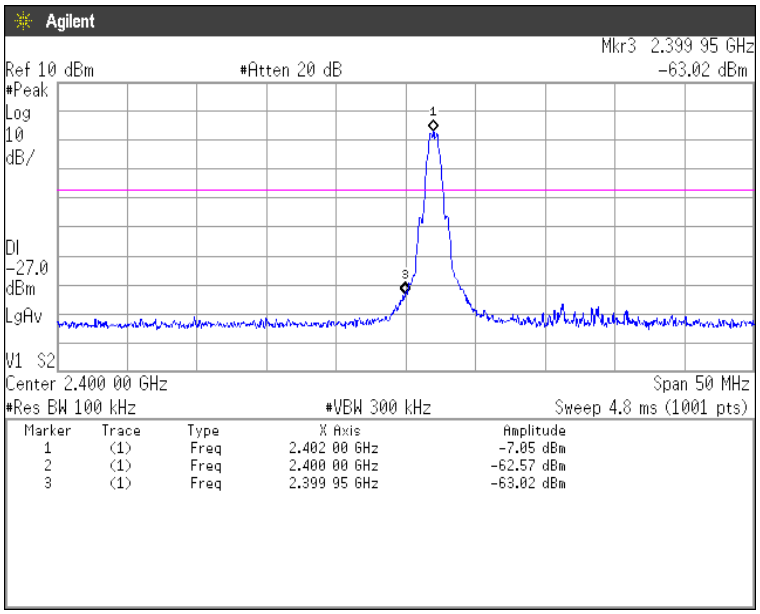
Test engineer : Chiaki Kanno

Channel	Frequency (MHz)	RF Power Level (dBm)	Band-edge Frequency (MHz)	Band-edge Level (dBm)	Difference Level (dBm)	Limit (dBm)	Result
Low	2402	-7.05	2399.95	-63.02	55.97	At least 20dB below from peak of RF	PASS
High	2480	-7.83	2483.55	-70.53	62.70	At least 20dB below from peak of RF	PASS

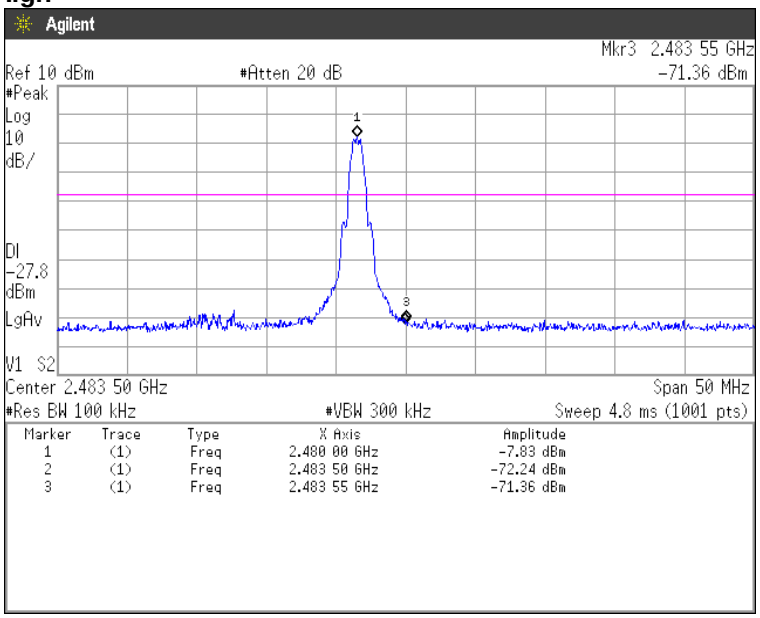
Japan

4.3.4 Trace data

Channel: Low



Channel: High



Japan

4.4 Spurious emissions - Conducted -

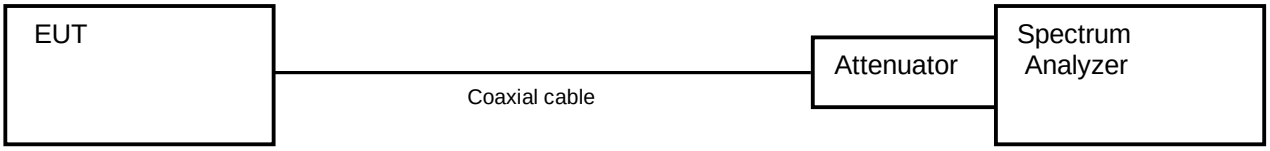
4.4.1 Measurement procedure

[FCC 15.247(d), KDB558074 D01 v05r02]

The spurious emissions (Conducted) are measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to;
a) Span = wide enough to fully capture the emission being measured.
b) RBW = 100 kHz
c) VBW ≥ RBW
d) Sweep time = auto-couple
e) Detector = peak
f) Trace mode = max hold

- Test configuration



4.4.2 Limit

In any 100kHz bandwidth outside the frequency band the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.

4.4.3 Measurement result

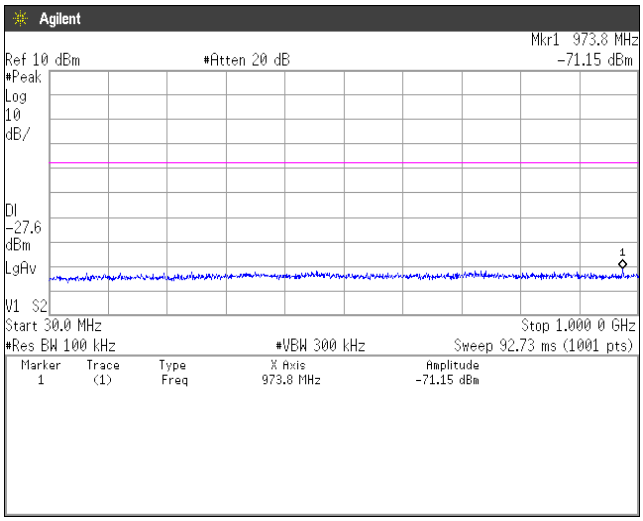
Date : 29-July-2021
Temperature : 23.1 [˚C]
Humidity : 64.1 [%]
Test place : Shielded room No.4
Test engineer : Chiaki Kanno

Channel	Frequency [MHz]	Limit [dB]	Results Chart	Result
Low	2402	At least 20dB below from peak of RF	See the trace Data	PASS
Middle	2440	At least 20dB below from peak of RF	See the trace Data	PASS
High	2480	At least 20dB below from peak of RF	See the trace Data	PASS

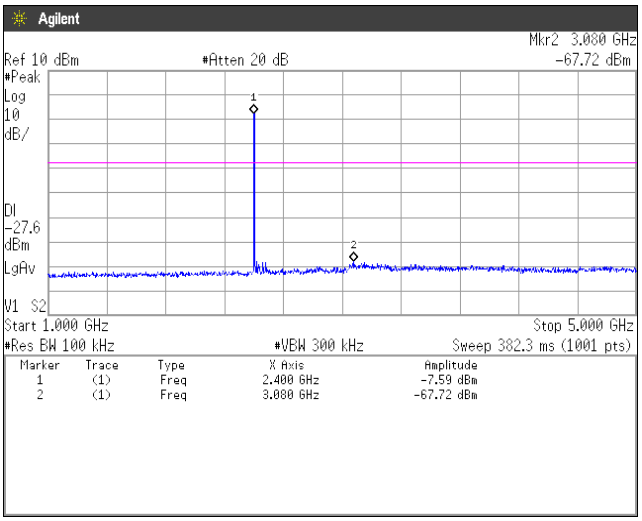
4.4.4 Trace data

Channel: Low

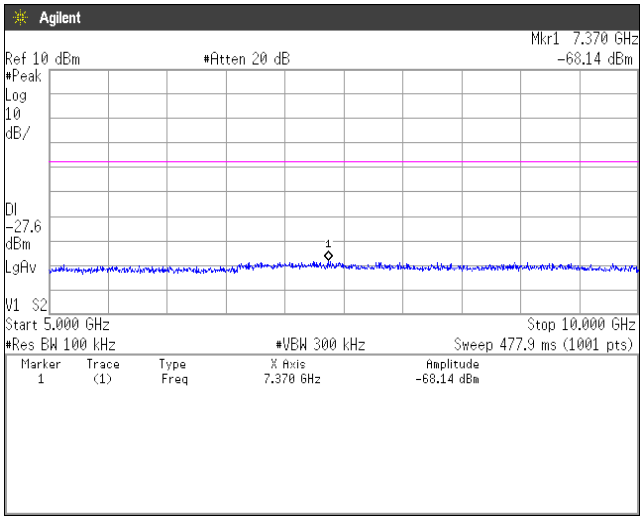
30 MHz-1 GHz



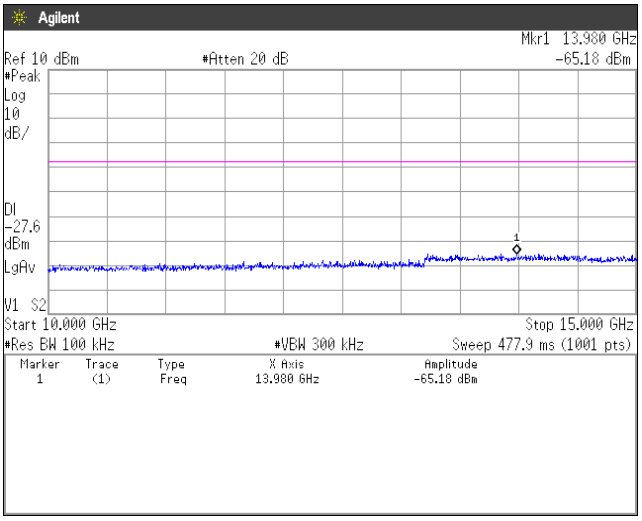
1 GHz-5 GHz



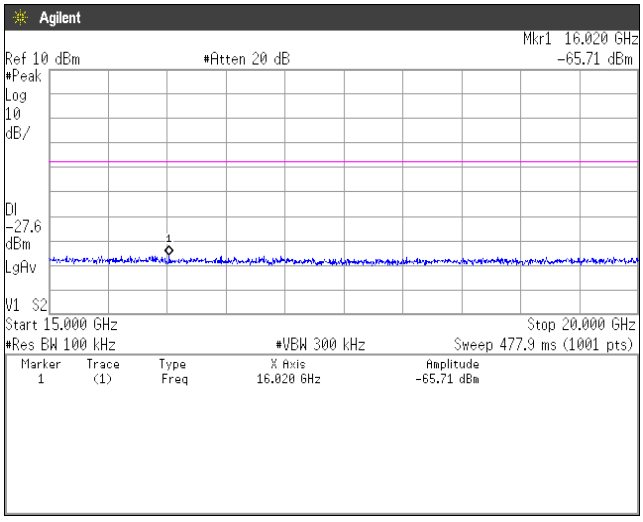
5 GHz-10 GHz



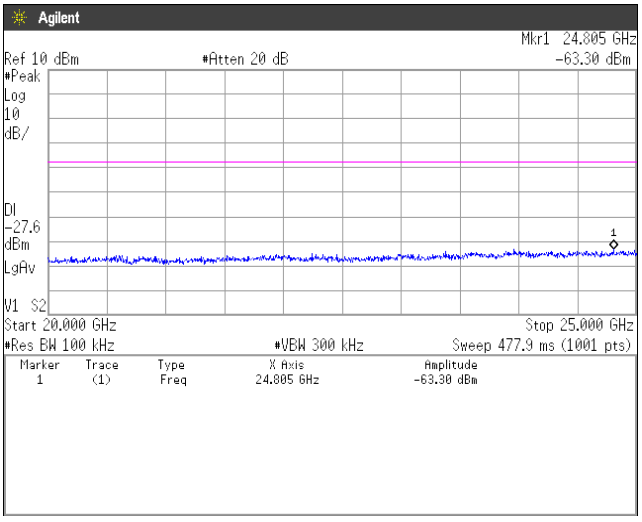
10 GHz-15 GHz



15 GHz-20 GHz

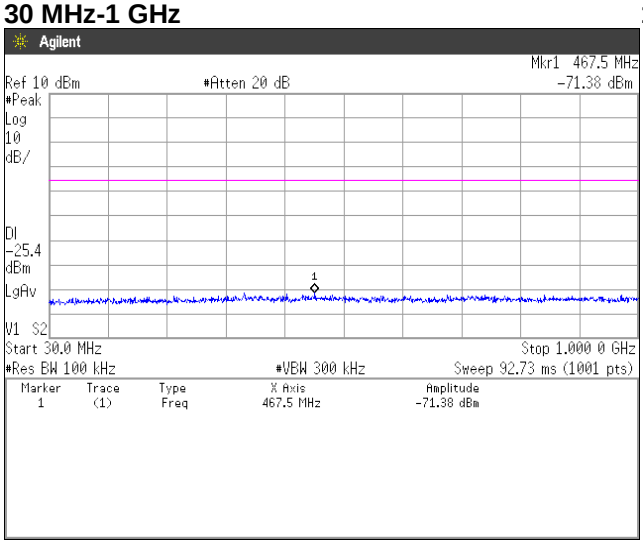


20 GHz-25 GHz

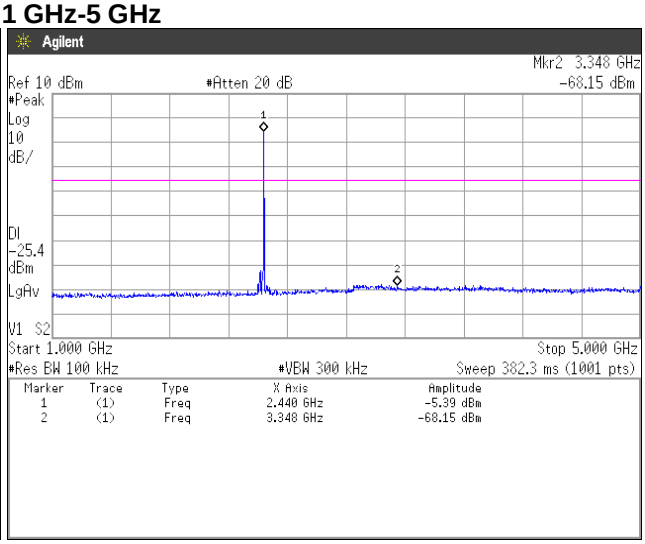


Channel: Middle

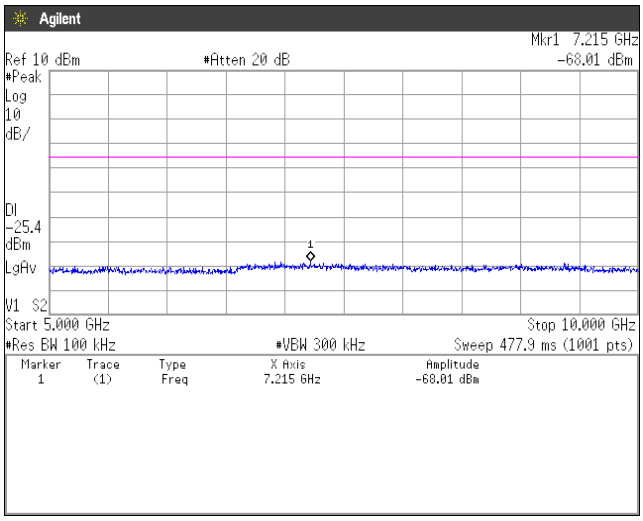
30 MHz-1 GHz



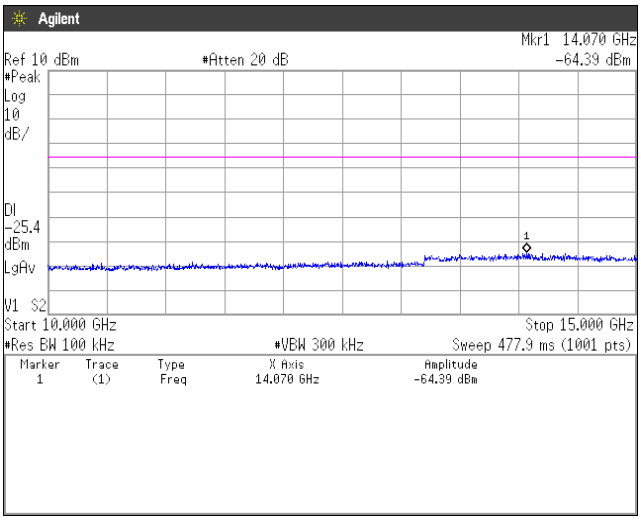
1 GHz-5 GHz



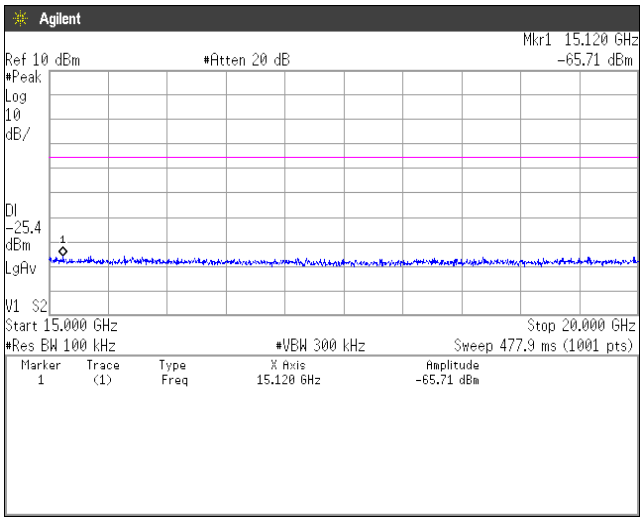
5 GHz-10 GHz



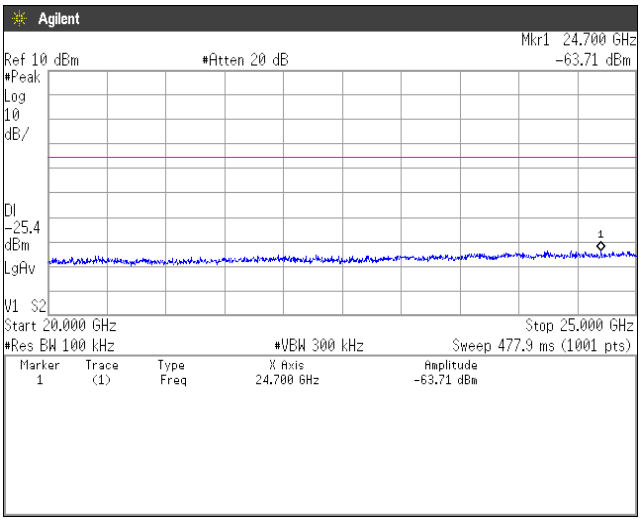
10 GHz-15 GHz



15 GHz-20 GHz

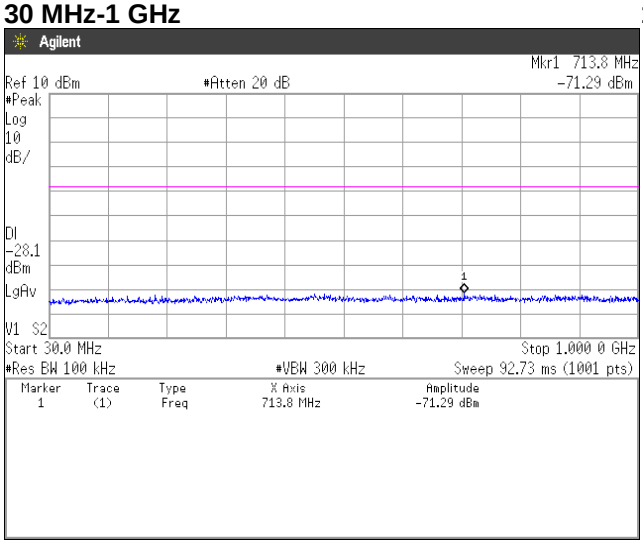


20 GHz-25 GHz

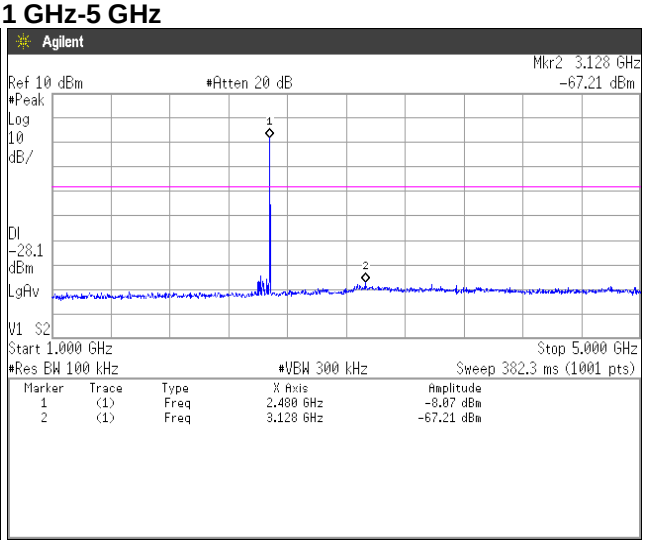


Channel: High

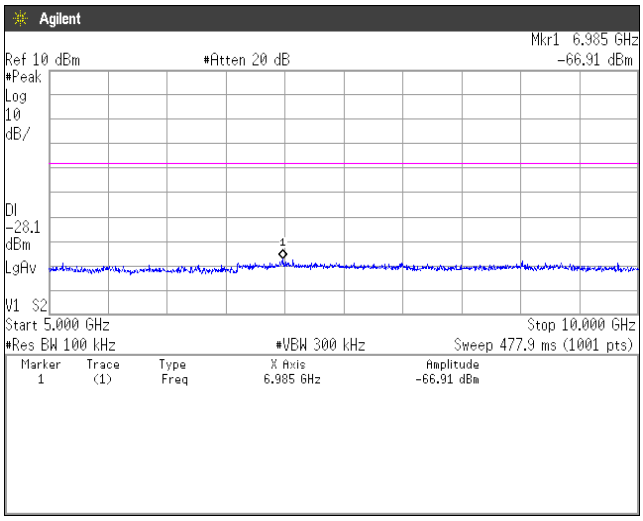
30 MHz-1 GHz



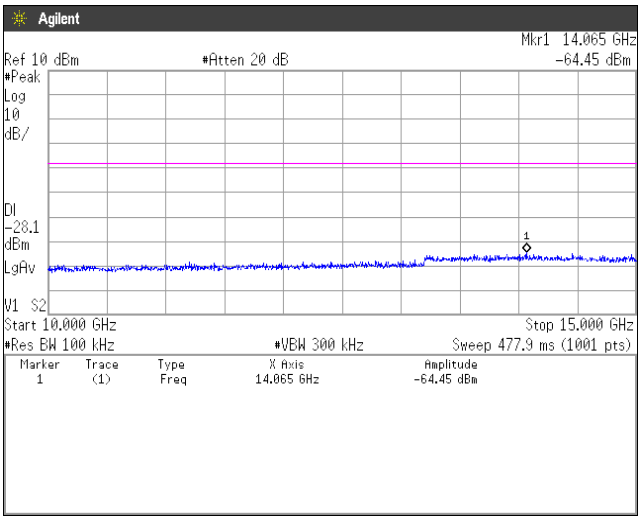
1 GHz-5 GHz



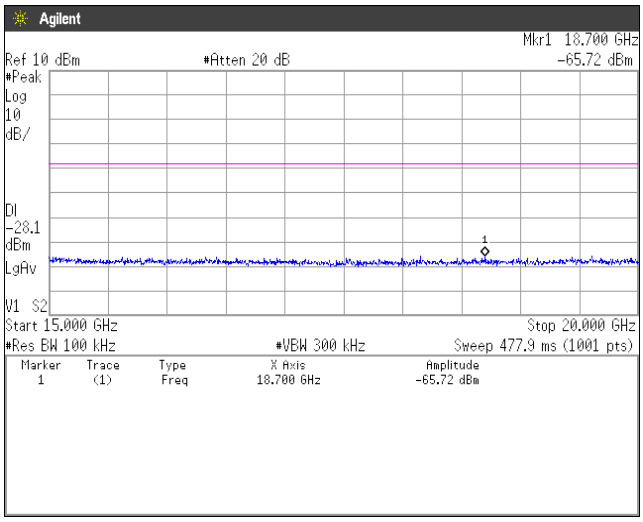
5 GHz-10 GHz



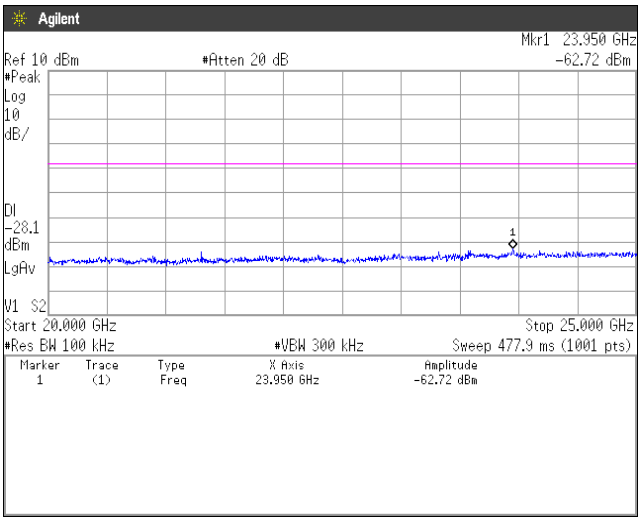
10 GHz-15 GHz



15 GHz-20 GHz



20 GHz-25 GHz



Japan

4.5 Spurious Emissions - Radiated -

4.5.1 Measurement procedure

[FCC 15.247(d), 15.205, 15.209, KDB558074 D01 v05r02]

Test was applied by following conditions.

Test method	:	ANSI C63.10
Frequency range	:	9kHz to 25GHz
Test place	:	3m Semi-anechoic chamber
EUT was placed on	:	Styrofoam table / (W)1.0m × (D)1.0m × (H)0.8m (below 1GHz) Styrofoam table / (W)0.6m × (D)0.6m ×(H)1.5m (above 1GHz)
Antenna distance	:	3m
Test receiver setting		Below 1GHz
- Detector	:	Average (9kHz-90kHz, 110kHz-490kHz), Quasi-peak
- Bandwidth	:	200Hz, 120kHz
Spectrum analyzer setting		Above 1GHz
- Peak	:	RBW=1MHz, VBW=3MHz, Span=0Hz, Sweep=auto
- Average	:	RBW=1MHz, VBW=3kHz, Span=0Hz, Sweep=auto Display mode=Linear

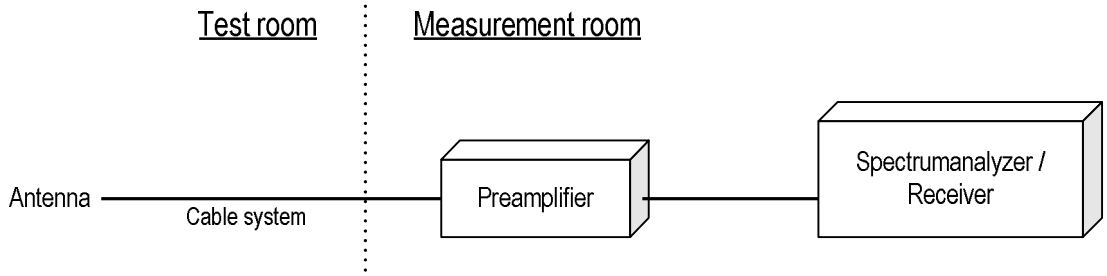
Average Measurement Setting [VBW]

Mode	Duty Cycle (%)	T_{on} (us)	T_{off} (us)	$1/T_{on}$ (kHz)	Determined VBW Setting
Bluetooth 4.2 LE	62.50	390	234	2.564	3kHz

Although these tests were performed other than open area test site,
adequate comparison measurements were confirmed against 30 m open are test site.
Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 937606.

Radiated emission measurements are performed at 3m distance with the broadband antenna (Loop antenna, Biconical antenna, Log periodic antenna, Double ridged guide antenna and Broad-band horn Antenna). The antenna is positioned both the horizontal and vertical planes of polarization and height is varied 1m to 4m and stopped at height producing the maximum emission. As for the Loop antenna, it is positioned with its plane vertical, and the center of the Loop antenna is 1m above the ground plane.
The EUT is Placed on a turntable, which is 0.8m/1.5m above ground plane. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level. The test results represent the worst case emission for each emission with manipulating the EUT, support equipment, interconnecting cables and varying the mode of operation. Sufficient time for the EUT, support equipment, and test equipment are allowed in order for them to warm up to their normal operating condition.

- Test configuration



4.5.2 Calculation method

[9kHz to 150kHz]
Emission level = Reading + (Ant factor + Cable system loss)
Margin = Limit – Emission level

[150kHz to 25GHz]
Emission level = Reading + (Ant factor + Cable system loss - Amp. Gain)
Margin = Limit – Emission level

Example:
Limit @ 4804.0MHz : 74.0dBuV/m (Peak Limit)
S.A Reading = 39.9dBuV Cable system loss = 8.3dB
Result = 39.9 + 8.3 = 48.2dBuV/m
Margin = 74.0 - 48.2 = 25.8dB

4.5.3 Limit

Frequency [MHz]	Field strength		Distance [m]
	[uV/m]	[dBuV/m]	
0.009-0.490	2400 / F [kHz]	20logE [uV/m]	300
0.490-1.705	24000 / F [kHz]	20logE [uV/m]	30
1.705-30	30	29.5	30
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Note:
1. The lower limit shall apply at the transition frequencies.
2. Emission level [dBuV/m] = 20log Emission [uV/m]
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition modulation.

Japan

4.5.4 Test data

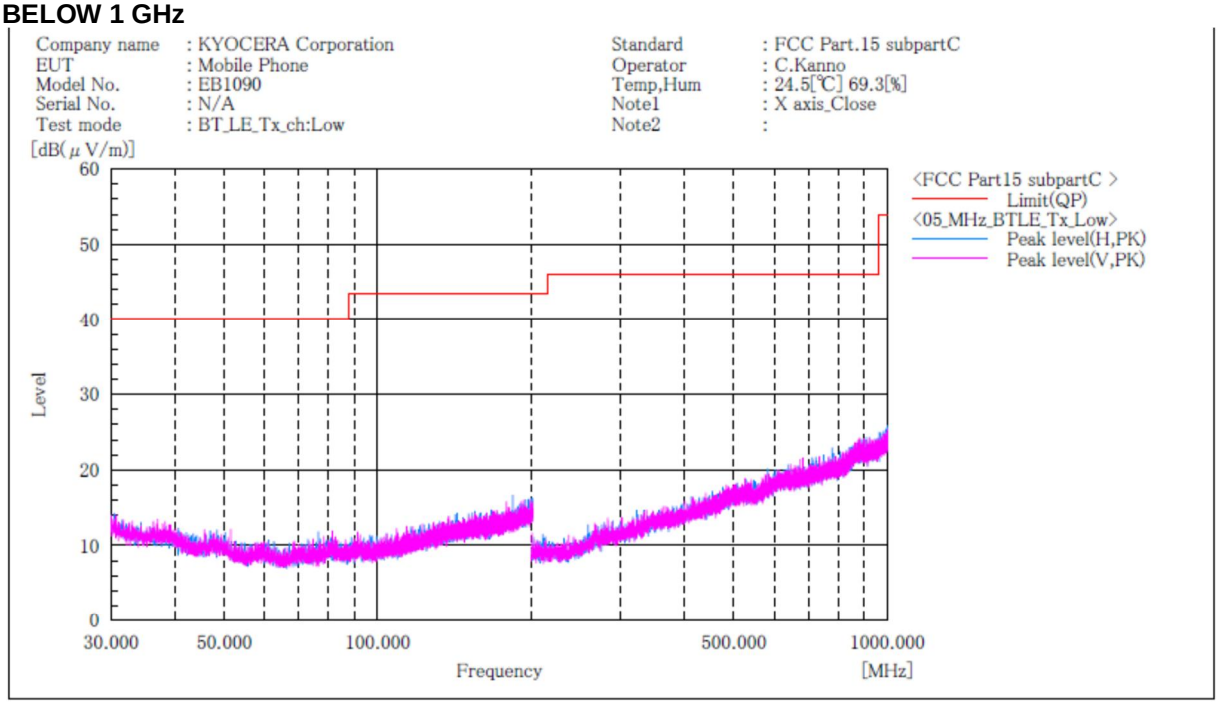
Date	:	26-July-2021			
Temperature	:	24.6 [˚C]			
Humidity	:	68.8 [%]	Test engineer	:	
Test place	:	3m Semi-anechoic chamber			Tadahiro Seino

Date	:	27-July-2021			
Temperature	:	24.5 [˚C]			
Humidity	:	69.3 [%]	Test engineer	:	
Test place	:	3m Semi-anechoic chamber			Chiaki Kanno

Date	:	28-July-2021			
Temperature	:	24.5 [˚C]			
Humidity	:	69.3 [%]	Test engineer	:	
Test place	:	3m Semi-anechoic chamber			Chiaki Kanno

Japan

[Transmission mode]
Channel: Low
BELOW 1 GHz



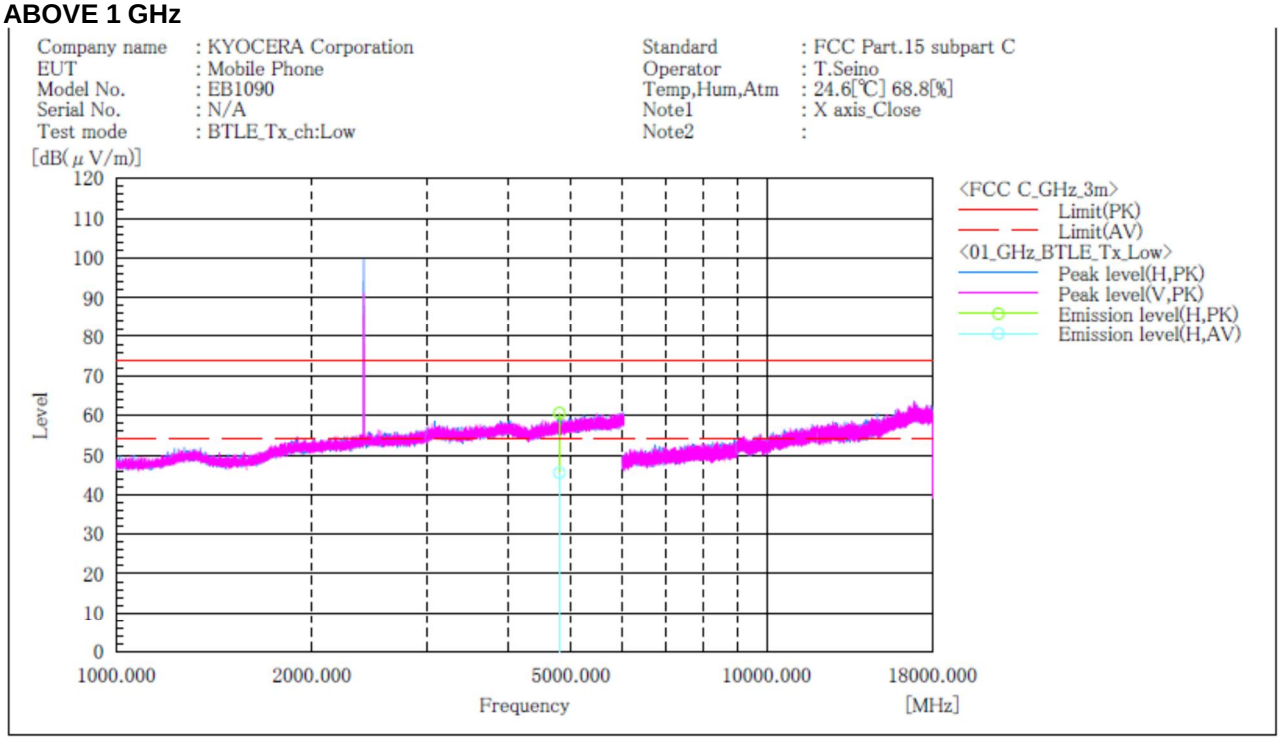
Final Result

No.	Frequency [MHz]	(P)	c.f [dB(1/m)]	Height [cm]	Angle [°]	Remark

Note:
1. Emission Level (Margin) = Limit - [Reading + Factor (Antenna + Cable – Amp)]
2. No emission were detected in frequency range 9kHz to 30MHz at the 3 meters distance.

Japan

Channel: Low
ABOVE 1 GHz



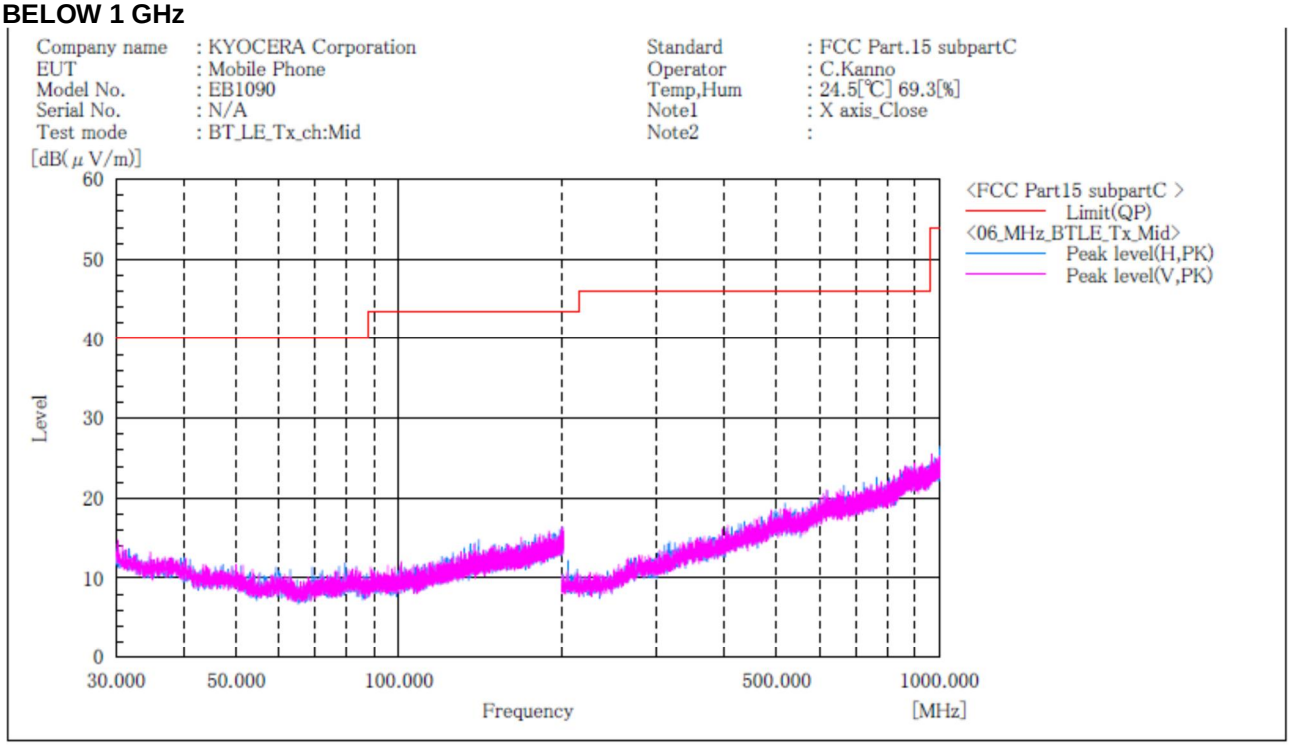
Final Result

No.	Frequency	(P)	Reading PK	Reading AV	c.f	Result PK	Result AV	Limit PK	Limit AV	Margin PK	Margin AV	Height	Angle	Remark
	[MHz]		[dB(μV)]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[dB]	[cm]	[°]	
1	4804.000	H	50.0	34.9	10.6	60.6	45.5	74.0	54.0	13.4	8.5	177.0	154.0	

Note:
1. Emission Level (Margin) = Limit - [Reading + Factor (Antenna + Cable – Amp)]
2. No emission were detected in frequency range 18GHz to 25GHz at the 3 meters distance.

Japan

Channel: Middle
BELOW 1 GHz



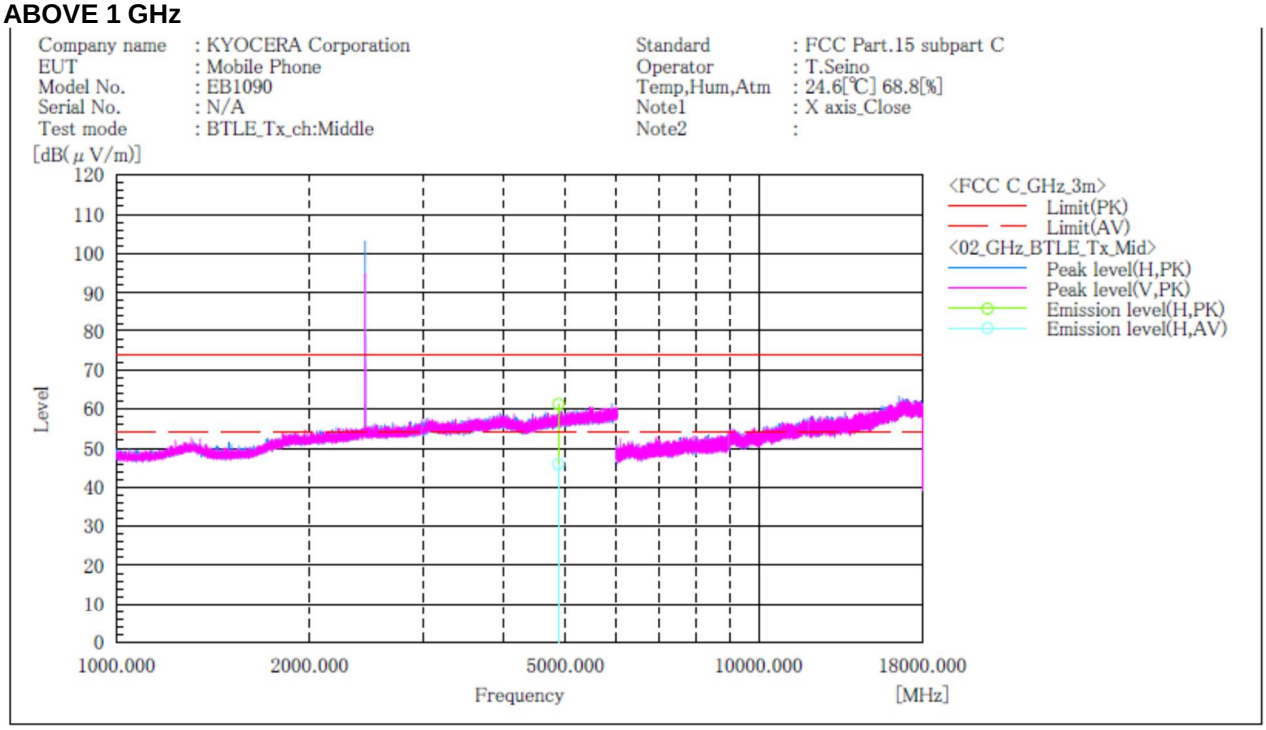
Final Result

No.	Frequency [MHz]	(P)	c.f [dB(1/m)]	Height [cm]	Angle [°]	Remark

Note:
1. Emission Level (Margin) = Limit - [Reading + Factor (Antenna + Cable – Amp)]
2. No emission were detected in frequency range 9kHz to 30MHz at the 3 meters distance.

Japan

Channel: Middle
ABOVE 1 GHz



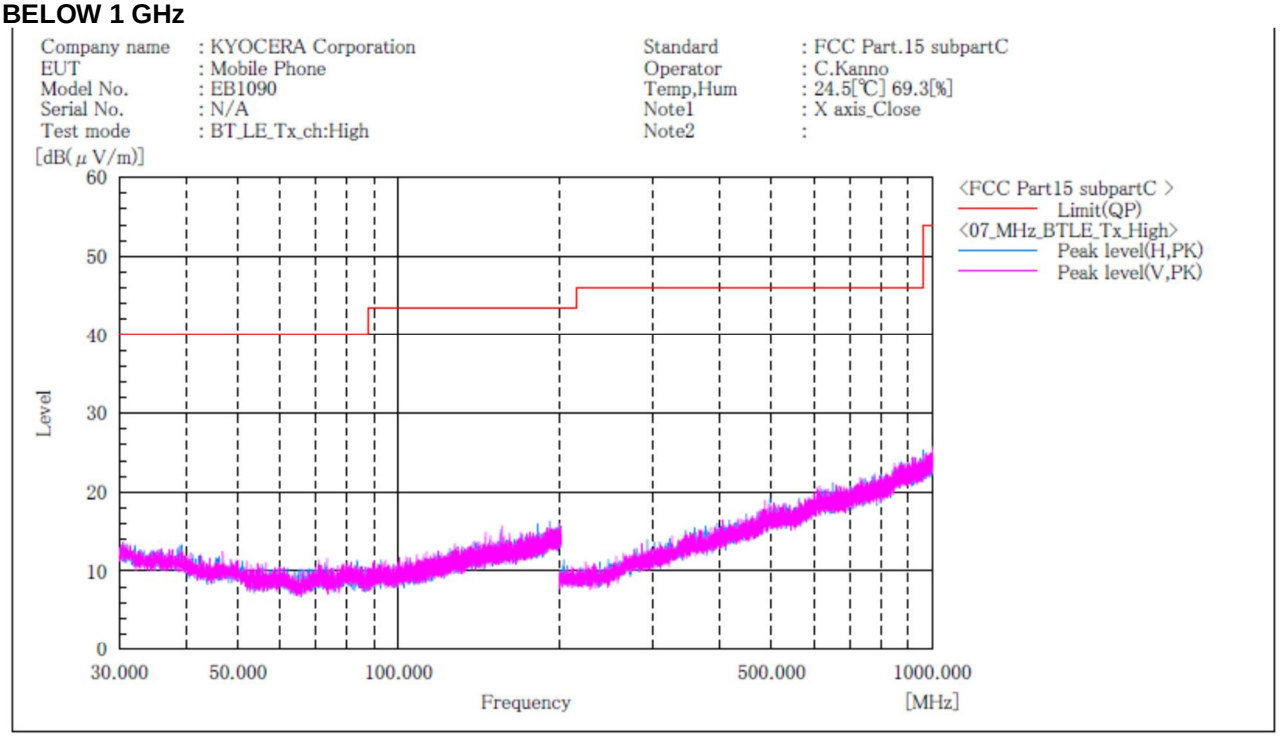
Final Result

No.	Frequency	(P)	Reading PK	Reading AV	c.f	Result PK	Result AV	Limit PK	Limit AV	Margin PK	Margin AV	Height	Angle	Remark
	[MHz]		[dB(μV)]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[dB]	[cm]	[°]	
1	4880.000	H	50.6	35.2	10.7	61.3	45.9	74.0	54.0	12.7	8.1	103.0	153.0	

Note:
1. Emission Level (Margin) = Limit - [Reading + Factor (Antenna + Cable – Amp)]
2. No emission were detected in frequency range 18GHz to 25GHz at the 3 meters distance.

Japan

Channel: High
BELOW 1 GHz



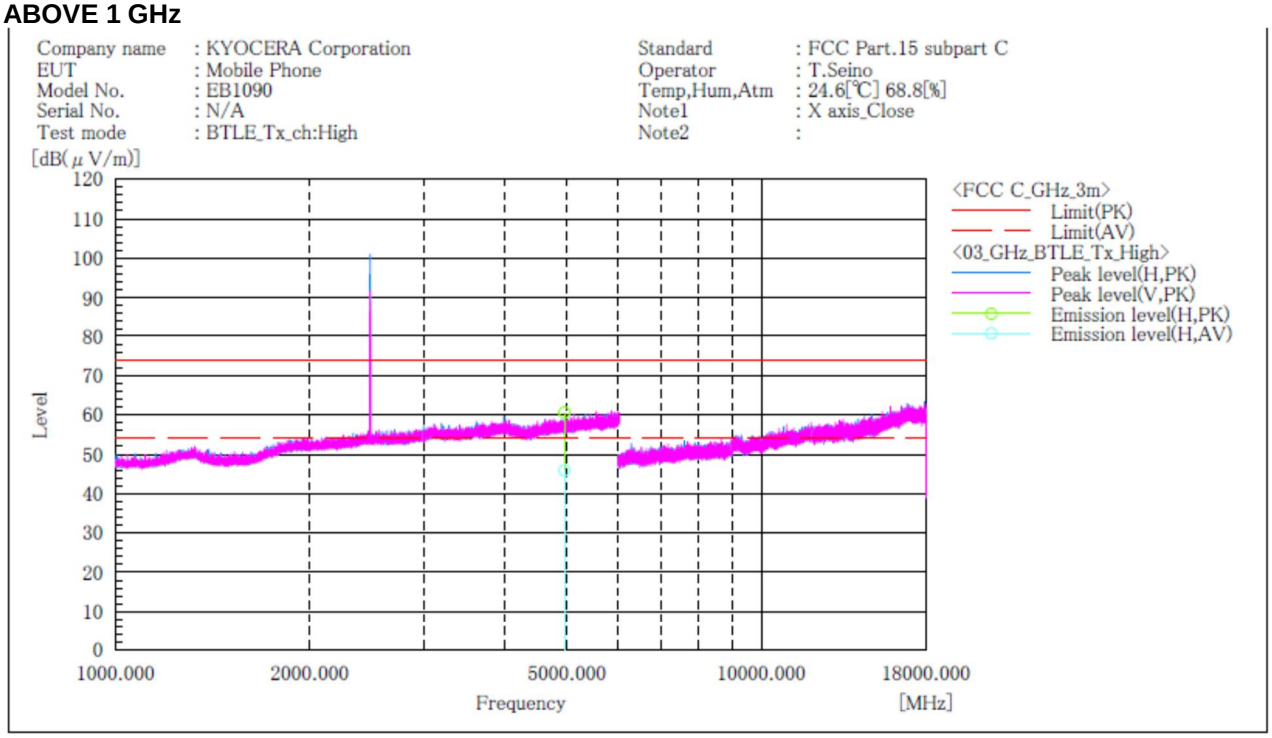
Final Result

No.	Frequency [MHz]	(P)	c.f [dB(1/m)]	Height [cm]	Angle [°]	Remark

Note:
1. Emission Level (Margin) = Limit - [Reading + Factor (Antenna + Cable – Amp)]
2. No emission were detected in frequency range 9kHz to 30MHz at the 3 meters distance.

Japan

Channel: High
ABOVE 1 GHz



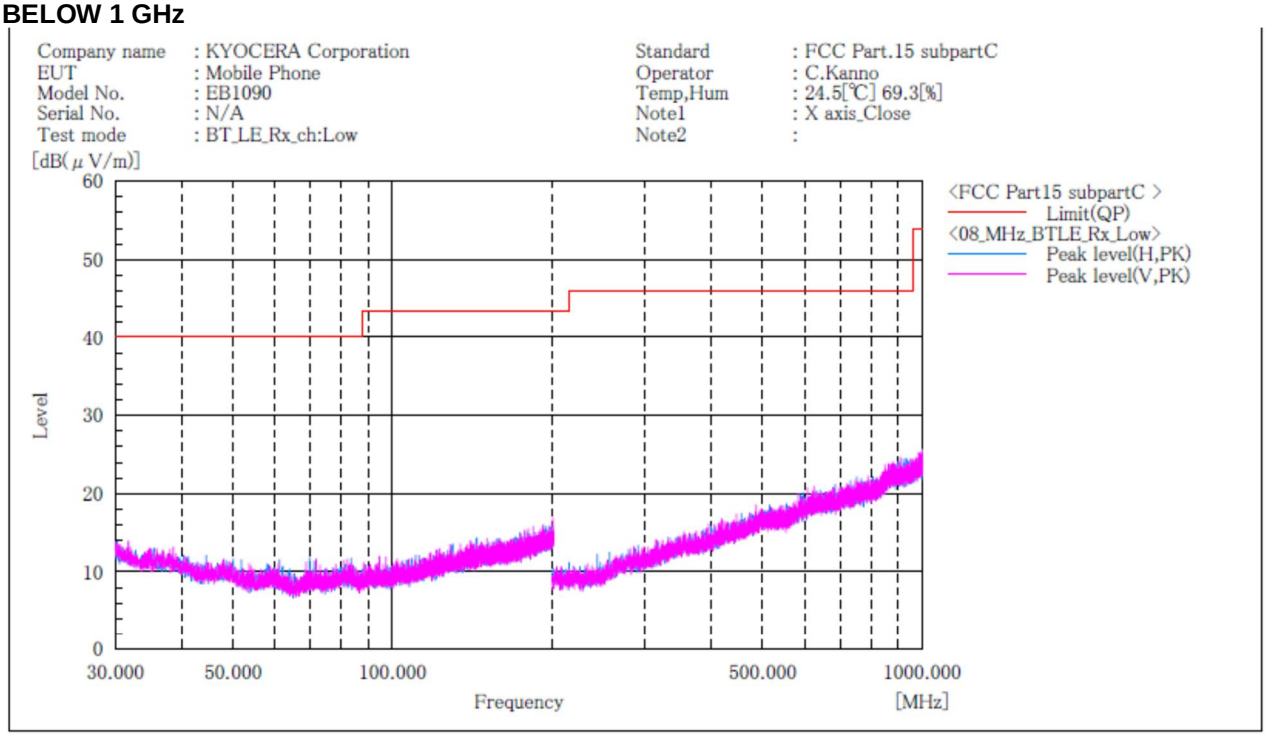
Final Result

No.	Frequency	(P)	Reading PK	Reading AV	c.f	Result PK	Result AV	Limit PK	Limit AV	Margin PK	Margin AV	Height	Angle	Remark
	[MHz]		[dB(μV)]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[dB]	[cm]	[°]	
1	4960.000	H	49.8	35.1	10.8	60.6	45.9	74.0	54.0	13.4	8.1	100.0	154.0	

Note:
1. Emission Level (Margin) = Limit - [Reading + Factor (Antenna + Cable – Amp)]
2. No emission were detected in frequency range 18GHz to 25GHz at the 3 meters distance.

Japan

[Receive mode]
Channel: Low
BELOW 1 GHz

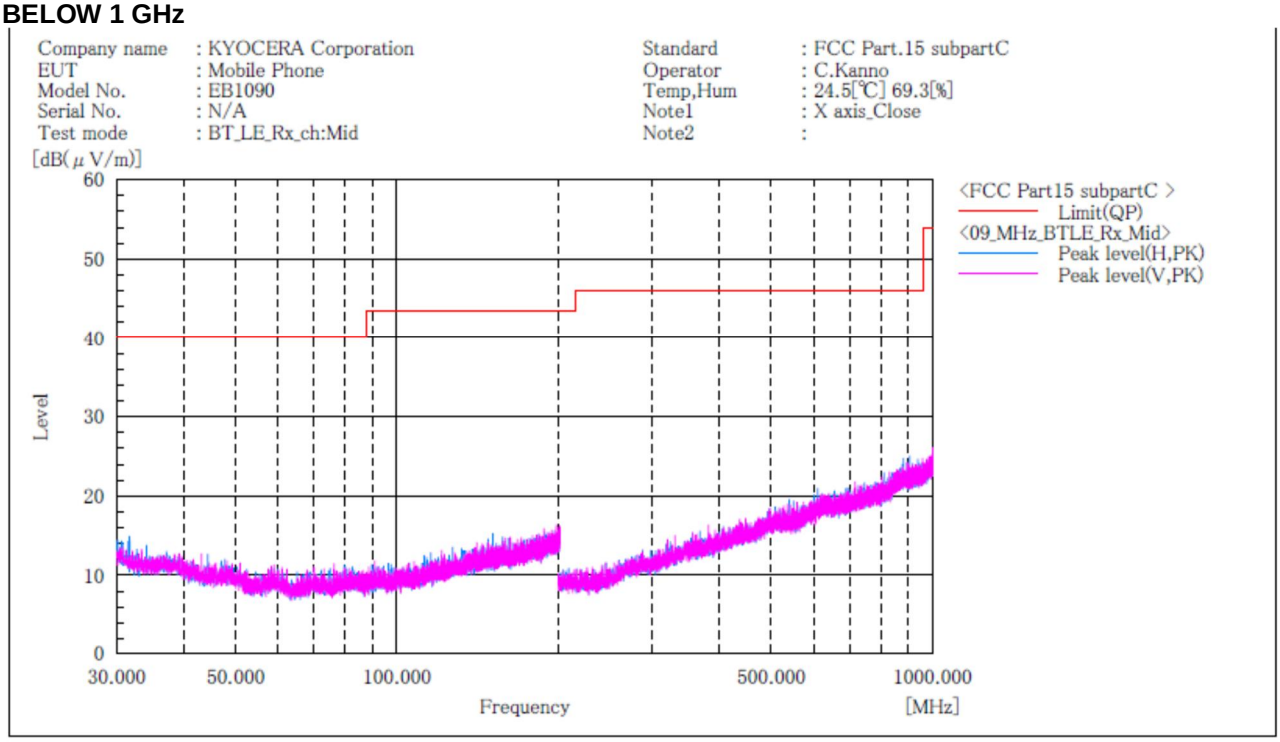


Final Result

No.	Frequency [MHz]	(P)	c.f [dB(1/m)]	Height [cm]	Angle [°]	Remark

Note:
1. Emission Level (Margin) = Limit - [Reading + Factor (Antenna + Cable – Amp)]
2. No emission were detected in frequency range 9kHz to 30MHz and 1GHz to 25GHz at the 3 meters distance.

Channel: Middle
BELOW 1 GHz



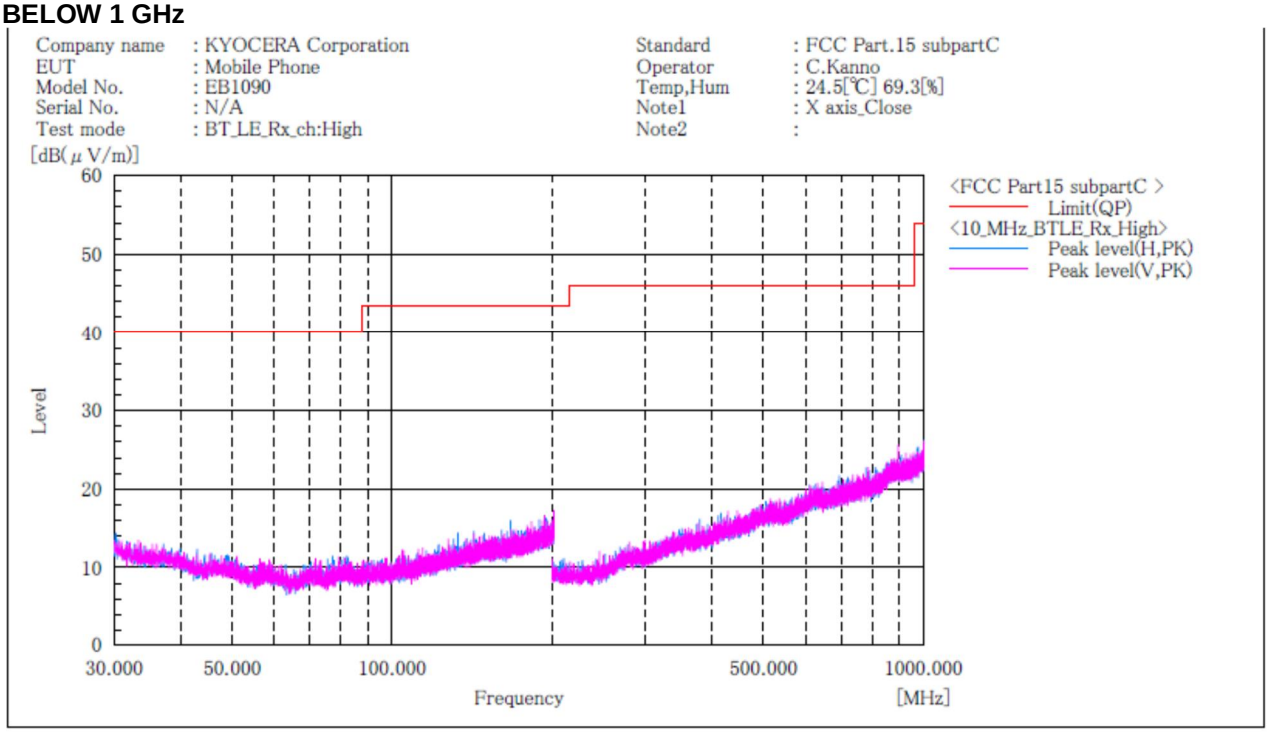
Final Result

No.	Frequency [MHz]	(P)	c.f [dB(1/m)]	Height [cm]	Angle [°]	Remark

Note:
1. Emission Level (Margin) = Limit - [Reading + Factor (Antenna + Cable – Amp)]
2. No emission were detected in frequency range 9kHz to 30MHz and 1GHz to 25GHz at the 3 meters distance.

Japan

Channel: High
BELOW 1 GHz



Final Result

No.	Frequency [MHz]	(P)	c.f [dB(1/m)]	Height [cm]	Angle [°]	Remark

Note:
1. Emission Level (Margin) = Limit - [Reading + Factor (Antenna + Cable – Amp)]
2. No emission were detected in frequency range 9kHz to 30MHz and 1GHz to 25GHz at the 3 meters distance.

Japan

4.6 Restricted Band of Operation

4.6.1 Measurement procedure

[FCC 15.247(d), 15.205, 15.209, KDB558074 D01 v05r02]

Test was applied by following conditions.

Test method	:	ANSI C63.10
Test place	:	3m Semi-anechoic chamber
EUT was placed on	:	Styrofoam table / (W)1.0m × (D)1.0m × (H)0.8m (below 1GHz) Styrofoam table / (W)0.6m × (D)0.6m ×(H)1.5m (above 1GHz)
Antenna distance	:	3m
Spectrum analyzer setting		
- Peak	:	RBW=1MHz, VBW=3MHz, Span=Arbitrary setting, Sweep=auto
- Average	:	RBW=1MHz, VBW=3kHz, Span=Arbitrary setting, Sweep=auto Display mode=Linear

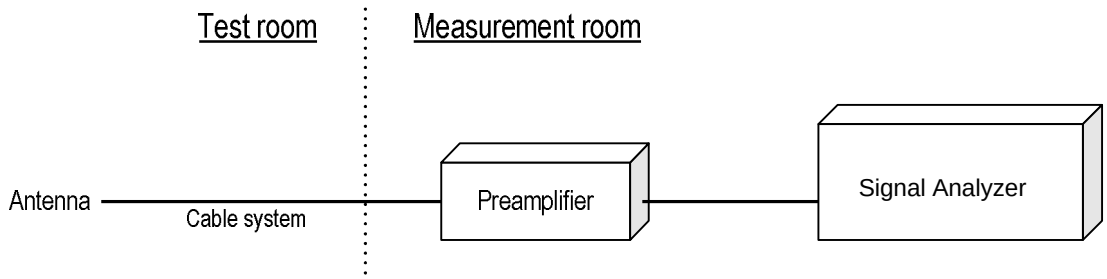
Average Measurement Setting [VBW]

Mode	Duty Cycle (%)	T_{on} (us)	T_{off} (us)	$1/T_{on}$ (kHz)	Determined VBW Setting
Bluetooth 4.2 LE	62.50	390	234	2.564	3kHz

Although these tests were performed other than open area test site,
adequate comparison measurements were confirmed against 30 m open are test site.
Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 937606.

Radiated emission measurements are performed at 3m distance with the broadband antenna (Loop antenna, Biconical antenna, Log periodic antenna, Double ridged guide antenna and Broad-band horn Antenna). The antenna is positioned both the horizontal and vertical planes of polarization and height is varied 1m to 4m and stopped at height producing the maximum emission. As for the Loop antenna, it is positioned with its plane vertical, and the center of the Loop antenna is 1m above the ground plane.
The EUT is Placed on a turntable, which is 0.8m/1.5m above ground plane. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level. The test results represent the worst case emission for each emission with manipulating the EUT, support equipment, interconnecting cables and varying the mode of operation. Sufficient time for the EUT, support equipment, and test equipment are allowed in order for them to warm up to their normal operating condition.

- Test configuration



Japan

4.6.2 Limit

Emission at the boundary of the restricted band provided by 15.205 shall be lower than 15.209 limit.

4.6.3 Measurement result

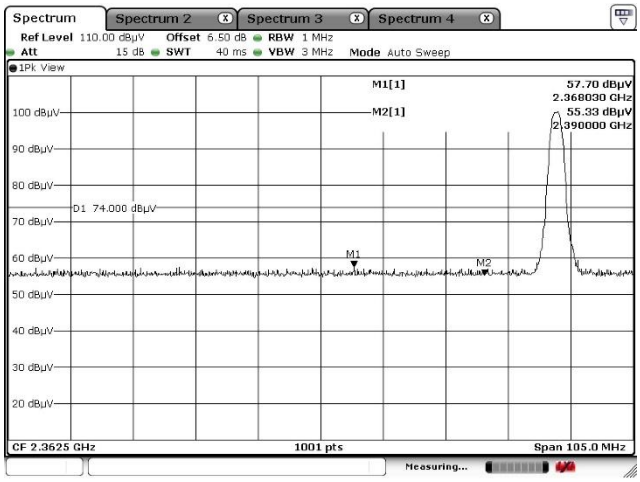
Channel	Frequency [MHz]	Results Chart	Result
Low	2402	See the Trace Data	Pass
High	2480	See the Trace Data	Pass

4.6.4 Test data

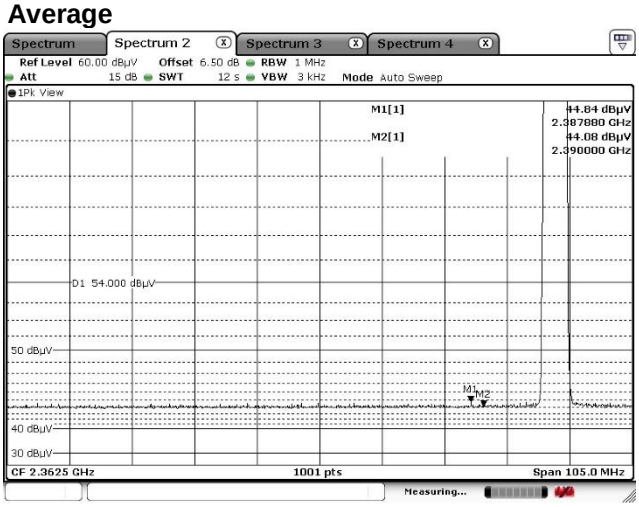
Date : 26-July-2021
Temperature : 24.6 [˚C]
Humidity : 68.8 [%]
Test place : 3m Semi-anechoic chamber

Test engineer : Tadahiro Seino

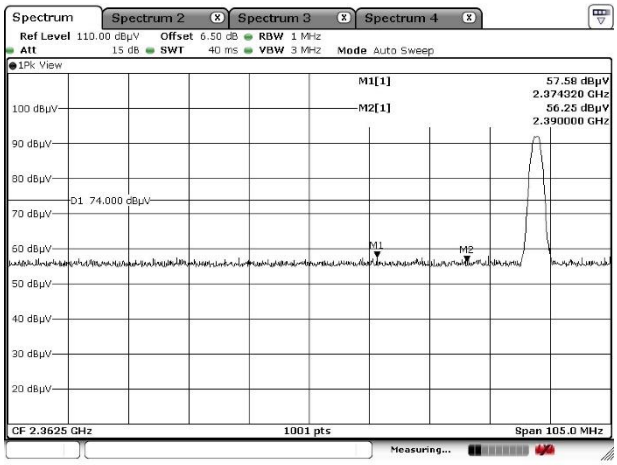
【CLOSE】
Channel: Low
Horizontal
Peak



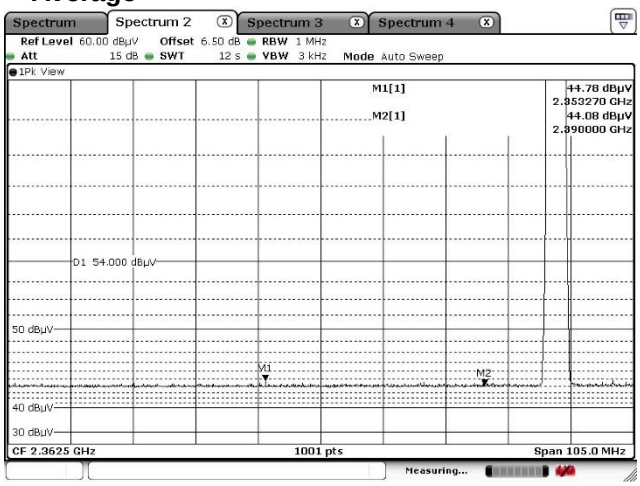
Average



Vertical
Peak

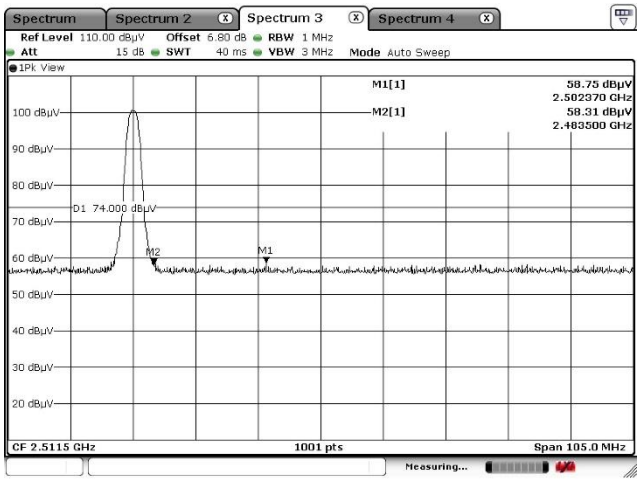


Average

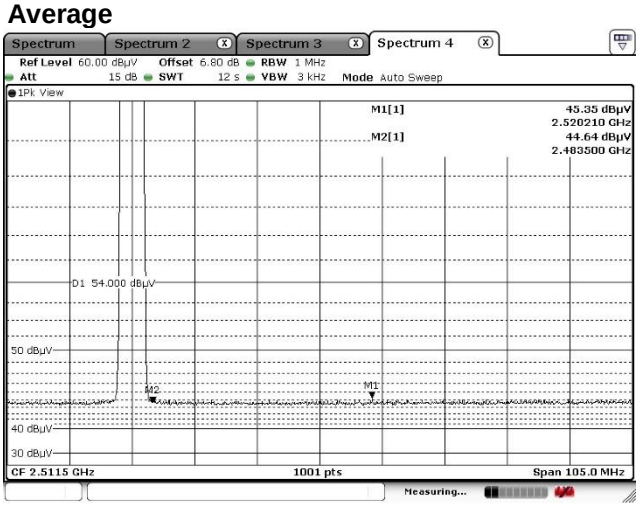


Japan

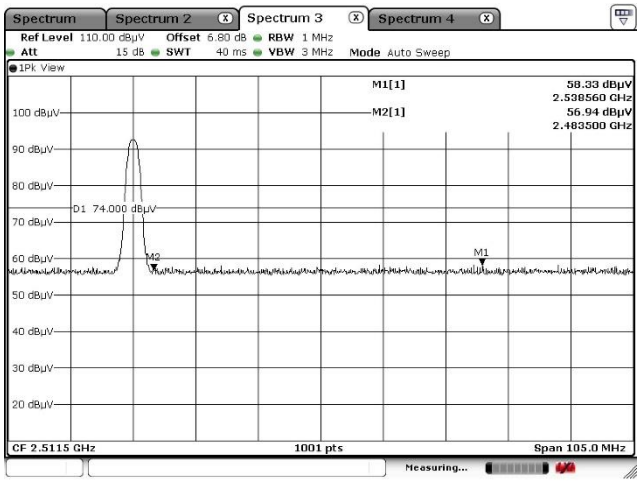
Channel: High
Horizontal
Peak



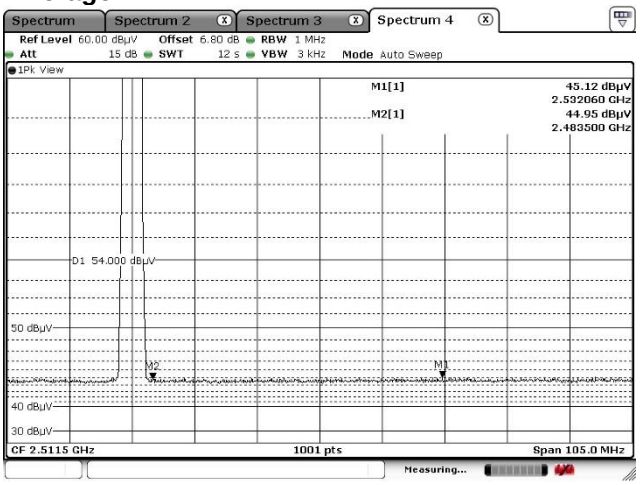
Average



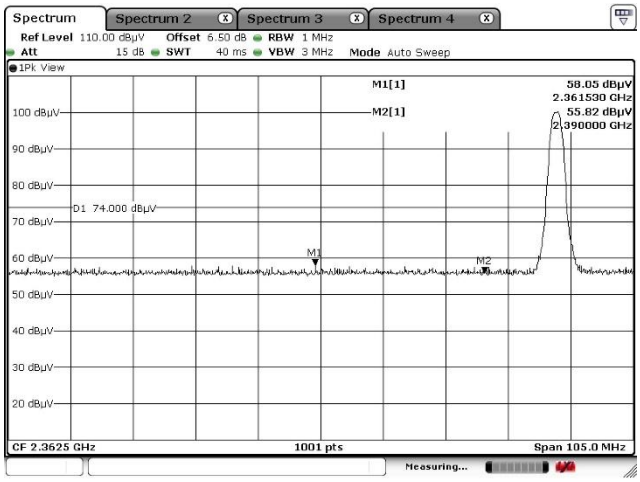
Vertical
Peak



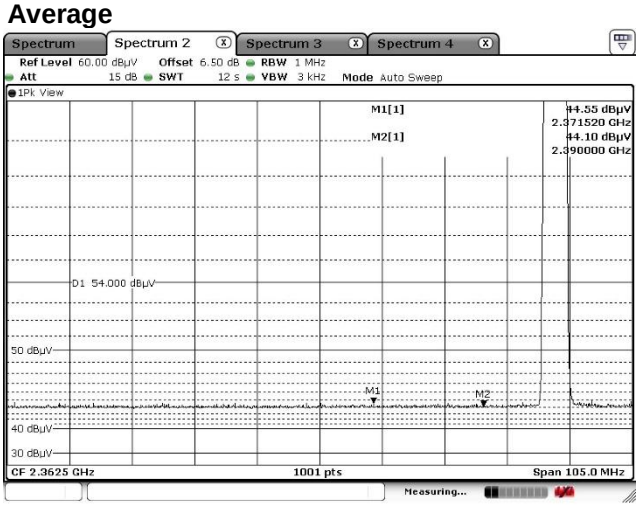
Average



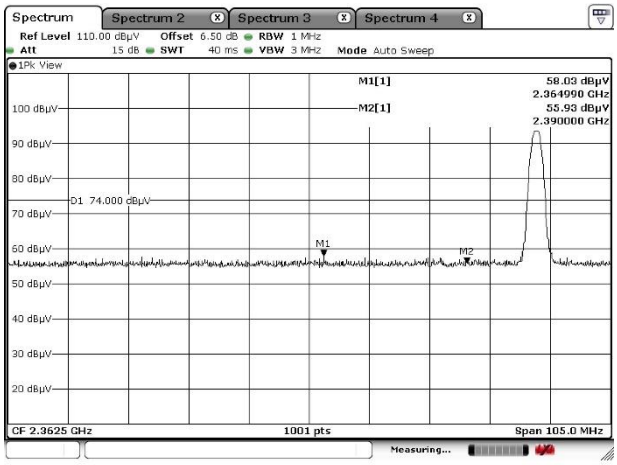
【OPEN】
Channel: Low
Horizontal
Peak



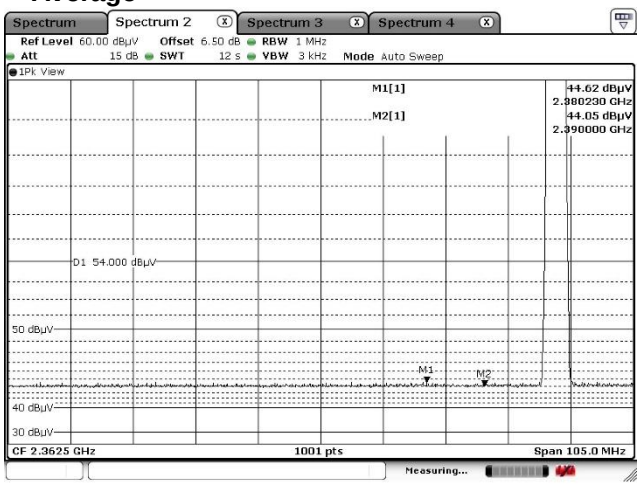
Average



Vertical
Peak

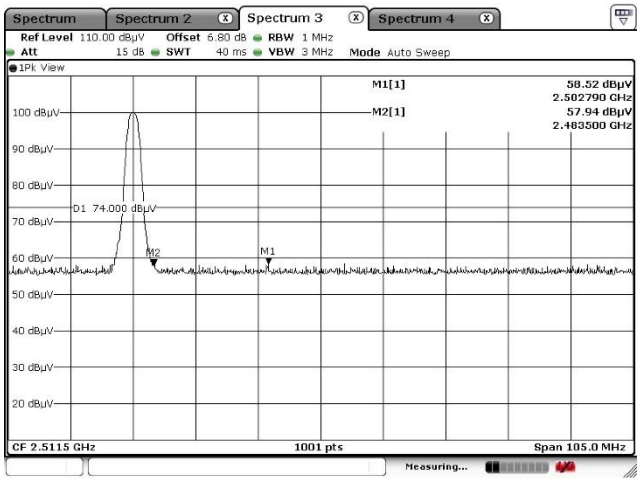


Average

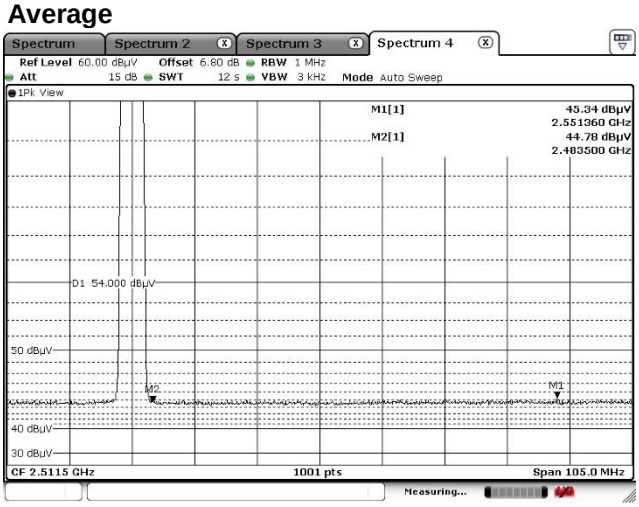


Japan

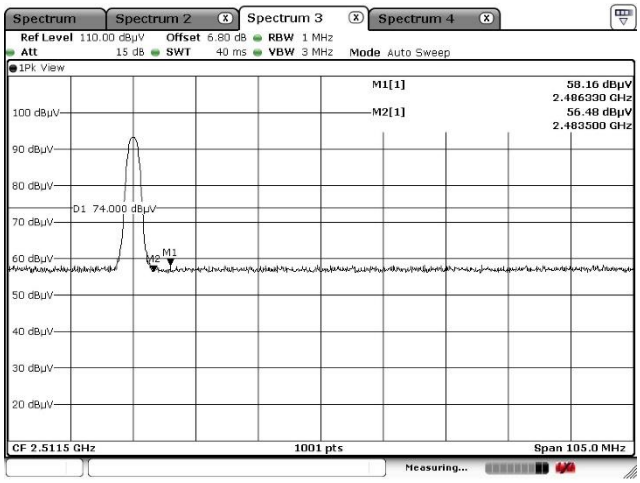
Channel: High
Horizontal
Peak



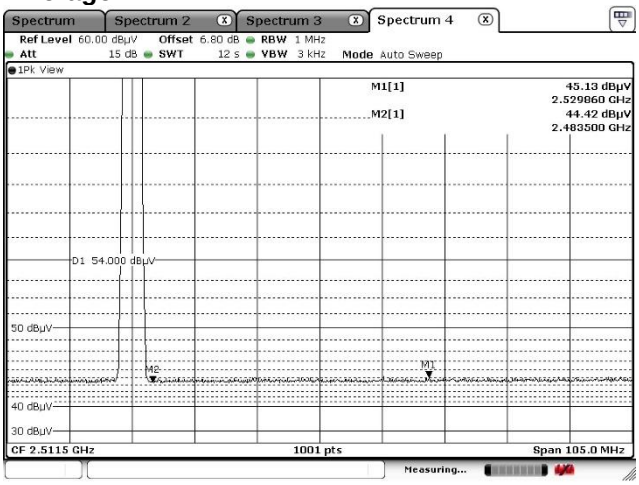
Average



Vertical
Peak



Average



Japan

4.7 Transmitter Power Spectral Density

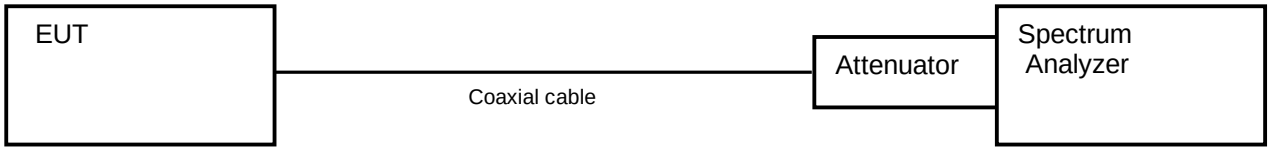
4.7.1 Measurement procedure

[FCC 15.247(e), KDB558074 D01 v05r02]

The peak power is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to;
a) Span = 1.5 times the 6 dB bandwidth.
b) RBW = 3kHz - 100kHz.
c) VBW ≥ 3 x RBW.
d) Sweep time = auto-couple.
e) Detector = peak.
f) Trace mode = max hold.

- Test configuration



4.7.2 Limit

The peak power spectral density shall not be greater than 8dBm in any 3kHz band.

4.7.3 Measurement result

Date : 29-July-2021
Temperature : 23.1 [˚C]
Humidity : 64.1 [%]
Test place : Shielded room No.4

Test engineer : Chiaki Kanno

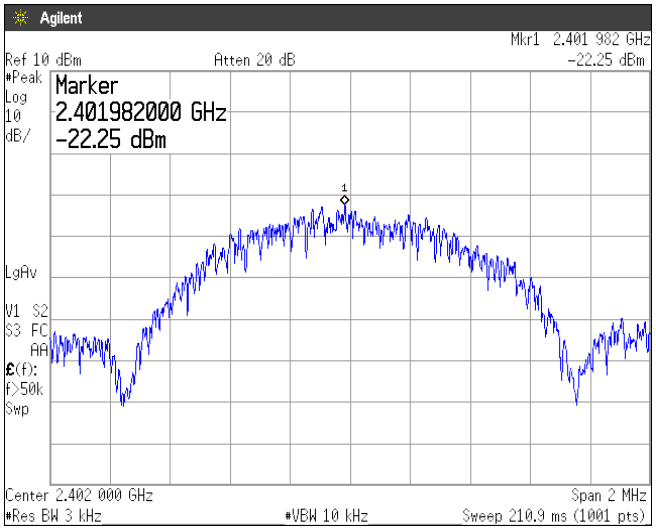
Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dBm)	Result
Low	2402	-22.25	10.49	-11.76	8.00	19.76	PASS
Middle	2440	-20.39	10.49	-9.90	8.00	17.90	PASS
High	2480	-23.01	10.49	-12.52	8.00	20.52	PASS

Calculation;
Transmitter Power Spectral Density Level (Margin) = Limit – (Reading + Factor)

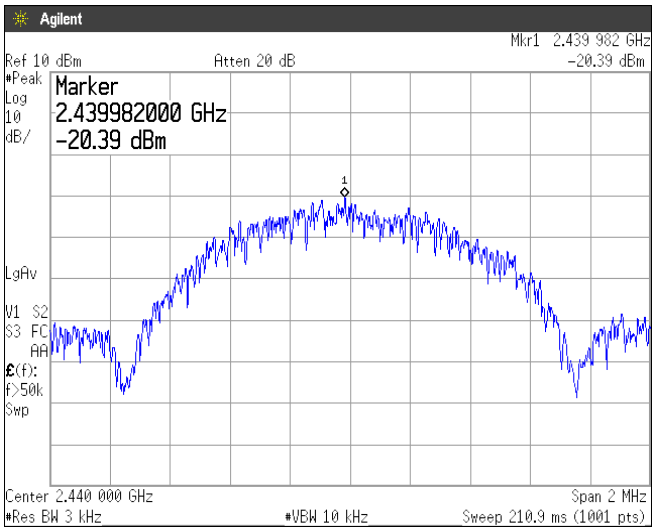
Japan

4.7.4 Trace data

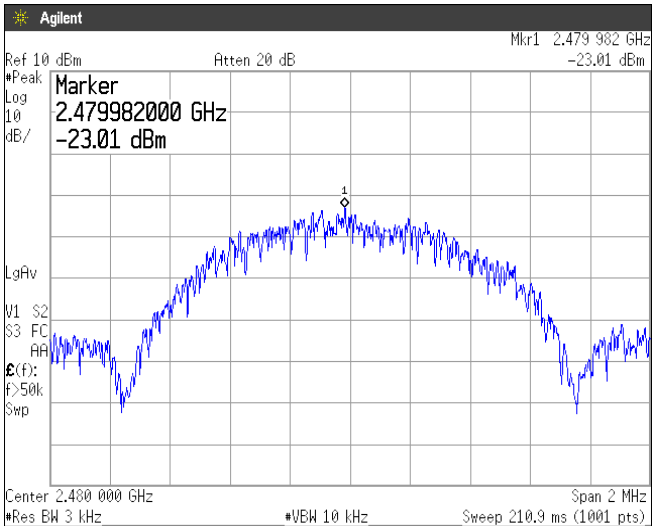
Channel Low



Channel Middle



Channel High



Japan

4.8 AC Power Line Conducted Emissions

4.8.1 Measurement procedure

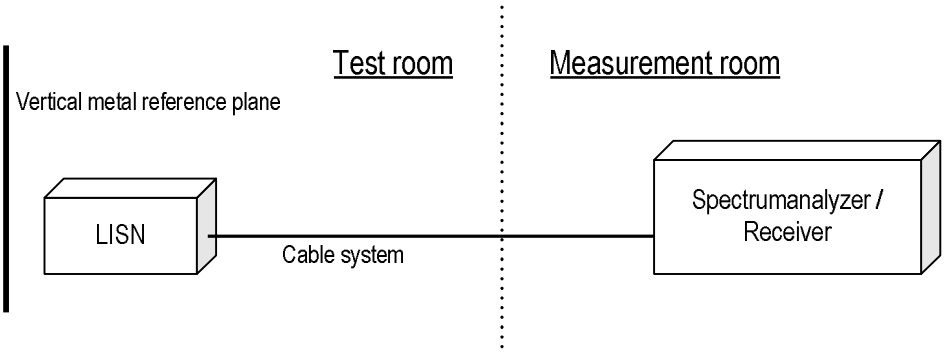
[FCC 15.207]

Test was applied by following conditions.

Test method	:	ANSI C63.10
Frequency range	:	0.15 MHz to 30 MHz
Test place	:	3 m Semi-anechoic chamber
EUT was placed on	:	FRP table / (W)2.0 m × (D)1.0 m × (H)0.8 m
Vertical Metal Reference Plane	:	(W)2.0 m × (H)2.0 m 0.4 m away from EUT
Test receiver setting		
- Detector	:	Quasi-peak, Average
- Bandwidth	:	9 kHz

EUT and peripherals are connected to 50Ω/50μH Line Impedance Stabilization Network (LISN) which are connected to reference ground plane, and are placed 80cm away from EUT. Excess of AC power cable is bundled in center.
LISN for peripheral is terminated in 50Ω.
EUT operating mode is selected to emit the maximum noise. Overall frequency range is investigated with spectrum analyzer using peak detector. Maximum emission configuration is determined by manipulating the EUT, peripherals, interconnecting cables. Then, emission measurements are performed with test receiver in above setting to each current-carrying conductor of the mains port. Sufficient time for EUT, peripherals and test equipment is provided in order for them to warm up to their normal operating condition. If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits.

- Test configuration



Japan

4.8.2 Calculation method

Emission level = Reading + (LISN. Factor + Cable system loss)
Margin = Limit – Emission level

Example:
Limit @ 6.770 MHz : 60.0 dBµV(Quasi-peak)
: 50.0 dBµV(Average)
(Quasi peak) Reading = 41.2 dBµV c.f = 10.3 dB
Emission level = 41.2 + 10.3 = 51.5 dBµV
Margin = 60.0 – 51.5 = 8.5 dB
(Average) Reading = 35.0 dBµV c.f = 10.3 dB
Emission level = 35.0 + 10.3 = 45.3 dBµV
Margin = 50.0 – 45.3 = 4.7 dB

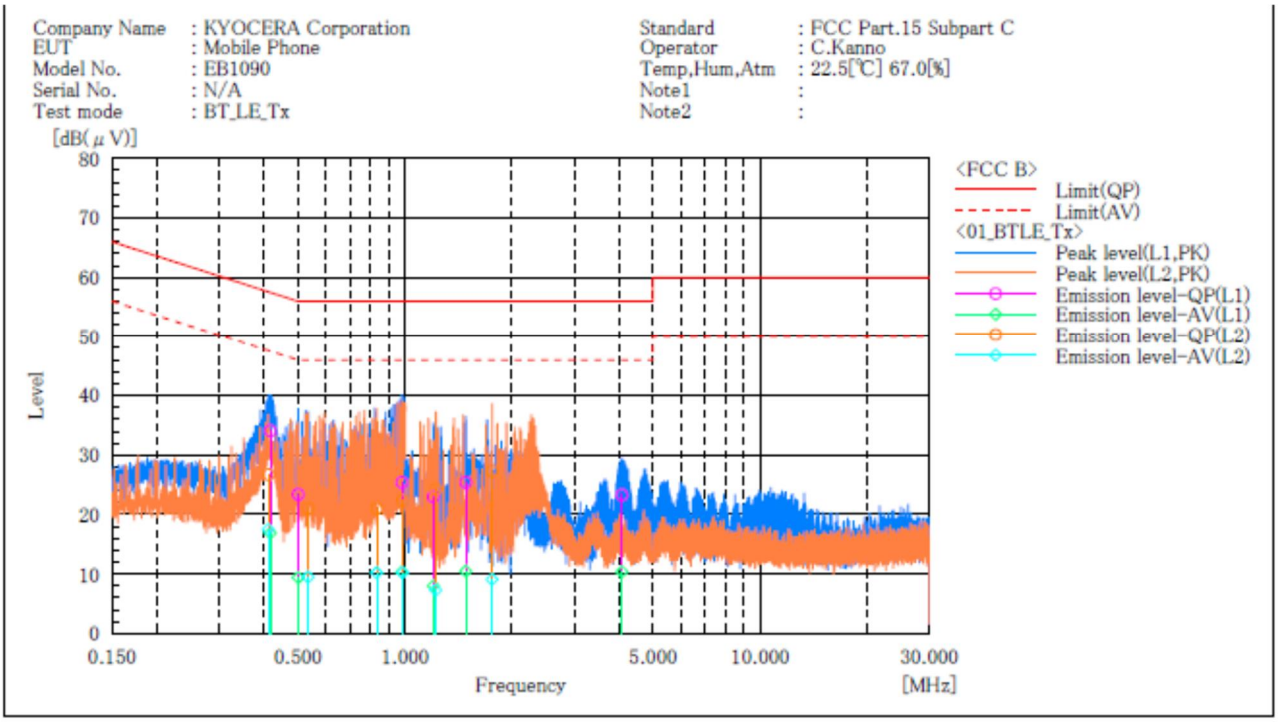
4.8.3 Limit

Frequency [MHz]	Limit	
	QP [dBuV]	AV [dBuV]
0.15-0.5	66-56*	56-46*
0.5-5	56	46
5-30	60	50

*: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

4.8.4 Test data

Date : 29-July-2021
Temperature : 22.5 [˚C]
Humidity : 67.0 [%] Test engineer : Chiaki Kanno
Test place : 3m Semi-anechoic chamber



Final Result

--- L1 Phase ---

No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading CAV [dB(μV)]	c.f [dB]	Result QP [dB(μV)]	Result CAV [dB(μV)]	Limit QP [dB(μV)]	Limit AV [dB(μV)]	Margin QP [dB]	Margin CAV [dB]
1	0.418	23.8	6.6	10.3	34.1	16.9	57.5	47.5	23.4	30.6
2	0.501	13.1	-0.9	10.3	23.4	9.4	56.0	46.0	32.6	36.6
3	0.981	15.1	0.1	10.3	25.4	10.4	56.0	46.0	30.6	35.6
4	1.204	12.7	-2.3	10.3	23.0	8.0	56.0	46.0	33.0	38.0
5	1.485	15.0	0.1	10.4	25.4	10.5	56.0	46.0	30.6	35.5
6	4.087	12.8	-0.1	10.5	23.3	10.4	56.0	46.0	32.7	35.6

--- L2 Phase ---

No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading CAV [dB(μV)]	c.f [dB]	Result QP [dB(μV)]	Result CAV [dB(μV)]	Limit QP [dB(μV)]	Limit AV [dB(μV)]	Margin QP [dB]	Margin CAV [dB]
1	0.413	16.4	7.2	10.3	26.7	17.5	57.6	47.6	30.9	30.1
2	0.534	10.7	-0.8	10.3	21.0	9.5	56.0	46.0	35.0	36.5
3	0.833	10.7	-0.1	10.3	21.0	10.2	56.0	46.0	35.0	35.8
4	0.985	12.1	-0.1	10.3	22.4	10.2	56.0	46.0	33.6	35.8
5	1.223	14.0	-3.0	10.3	24.3	7.3	56.0	46.0	31.7	38.7
6	1.762	17.0	-1.2	10.3	27.3	9.1	56.0	46.0	28.7	36.9

Japan

5 Antenna requirement

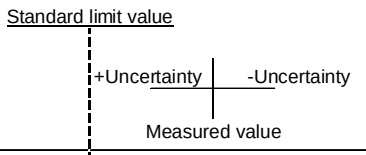
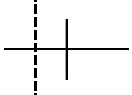
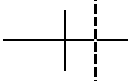
According to FCC section 15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.
The antenna is a special antenna mounted inside of the EUT. Therefore, the EUT complies with the antenna requirement of FCC section 15.203.

Japan

6 Measurement Uncertainty

Expanded uncertainties stated are calculated with a coverage Factor k=2.
Please note that these results are not taken into account when measurement uncertainty considerations contained in ETSI TR 100 028 Parts 1 and 2 determining compliance or non-compliance with test result.

Test item	Measurement uncertainty
Conducted emission, AMN (9 kHz – 150 kHz)	±3.8 dB
Conducted emission, AMN (150 kHz – 30 MHz)	±3.4 dB
Radiated emission (9kHz – 30 MHz)	±3.9 dB
Radiated emission (30 MHz – 1000 MHz)	±4.9 dB
Radiated emission (1 GHz – 6 GHz)	±4.6 dB
Radiated emission (6 GHz – 18 GHz)	±4.9 dB
Radiated emission (18 GHz – 40 GHz)	±5.8 dB
Radio Frequency	$\pm 1.4 * 10^{-8}$
RF power, conducted	±0.6 dB
Temperature	±0.6 °C
Humidity	±1.2 %
Voltage (DC)	±0.4 %
Voltage (AC, <10kHz)	±0.2 %

Judge	Measured value and standard limit value
PASS	**Case1**  Even if it takes uncertainty into consideration, a standard limit value is fulfilled.
	Case2  Although measured value is in a standard limit value, a limit value won't be fulfilled if uncertainty is taken into consideration.
FAIL	**Case3**  Although measured value exceeds a standard limit value, a limit value will be fulfilled if uncertainty is taken into consideration.
	Case4 Even if it takes uncertainty into consideration, a standard limit value isn't fulfilled.

Japan

7 Laboratory Information

Testing was performed and the report was issued at:

TÜV SÜD Japan Ltd. Yonezawa Testing Center

Address: 5-4149-7 Hachimanpara, Yonezawa-shi, Yamagata, 992-1128 Japan
Phone: +81-238-28-2881
Fax: +81-238-28-2888

Accreditation and Registration
A2LA
Certificate #3686.03

VLAC
Accreditation No.: VLAC-013

BSMI
Laboratory Code: SL2-IN-E-6018, SL2-A1-E-6018

Innovation, Science and Economic Development Canada
ISED#: 4224A

VCCI Council
Registration number: A-0166

Appendix A. Test Equipment

Antenna port conducted test

Equipment	Company	Model No.	Serial No.	Cal. Due	Cal. Date
Spectrum analyzer	Agilent Technologies	E4440A	US44302655	31-Aug-2021	20-Aug-2020
Attenuator	Weinschel	56-10	J4993	31-Dec-2021	14-Dec-2020
Power meter	ROHDE&SCHWARZ	NRP2	103269	31-Mar-2022	10-Mar-2021
Power sensor	ROHDE&SCHWARZ	NRP-Z81	102467	31-Mar-2022	10-Mar-2021

Radiated emission

Equipment	Company	Model No.	Serial No.	Cal. Due	Cal. Date
EMI Receiver	ROHDE&SCHWARZ	ESCI	100765	30-Sep-2021	28-Sep-2020
Spectrum analyzer	Agilent Technologies	E4447A	MY46180188	31-Mar-2022	11-Mar-2021
Spectrum analyzer	Agilent Technologies	E4440A	US40420937	31-Dec-2021	11-Dec-2020
Spectrum analyzer	ROHDE&SCHWARZ	FSV40	101731	30-Jun-2022	08-Jun-2021
Preamplifier	SONOMA	310	372170	30-Sep-2021	29-Sep-2020
Loop antenna	ROHDE&SCHWARZ	HFH2-Z2	100515	30-Apr-2022	27-Apr-2021
Biconical antenna	Schwarzbeck	VHBB9124/BBA9106	1333	31-Dec-2021	15-Dec-2020
Log periodic antenna	Schwarzbeck	VUSLP9111B	345	31-Oct-2021	19-Oct-2020
Attenuator	TOYO Connector	NA-PJ-6/6dB	N/A(S541)	30-Sep-2021	29-Sep-2020
Attenuator	TAMAGAWA.ELEC	CFA-10/3dB	N/A(S503)	31-Jul-2022	20-Jul-2021
Preamplifier	TSJ	MLA-100M18-B02-40	1929118	31-Dec-2021	15-Dec-2020
Attenuator	AEROFLEX	26A-10	081217-08	31-Dec-2021	14-Dec-2020
Double ridged guide antenna	ETS LINDGREN	3117	00052315	31-Mar-2022	30-Mar-2021
Attenuator	HUBER+SUHNER	6803.17.B	N/A(2340)	31-Dec-2021	15-Dec-2020
Double ridged guide antenna	A.H.Systems Inc.	SAS-574	469	30-Sep-2021	02-Sep-2020
Preamplifier	TSJ	MLA-1840-B03-35	1240332	30-Sep-2021	02-Sep-2020
Band rejection filter	Micro-Tronics	BRC50702	G433	30-Sep-2021	29-Sep-2020
Microwave cable	HUBER+SUHNER	SUCOFLEX104/9m	MY30037/4	31-Dec-2021	15-Dec-2020
		SUCOFLEX104/1m	my24610/4	31-Dec-2021	15-Dec-2020
		SUCOFLEX104/8m	SN MY30033/4	31-Dec-2021	15-Dec-2020
		SUCOFLEX104	MY32976/4	31-Dec-2021	15-Dec-2020
		SUCOFLEX104/1.5m	SN MY28404/4	31-Dec-2021	15-Dec-2020
		SUCOFLEX104/7m	41625/6	31-Dec-2021	15-Dec-2020
PC	DELL	DIMENSION E521	75465BX	N/A	N/A
Software	TOYO Corporation	EP5/RE-AJ	0611193/V6.0.140	N/A	N/A
Absorber	RIKEN	PFP30	N/A	N/A	N/A
3m Semi an-echoic Chamber	TOKIN	N/A	N/A(9002-NSA)	31-May-2022	20-May-2021
3m Semi an-echoic Chamber	TOKIN	N/A	N/A(9002-SVSWR)	31-May-2022	20-May-2021

Conducted emission at mains port

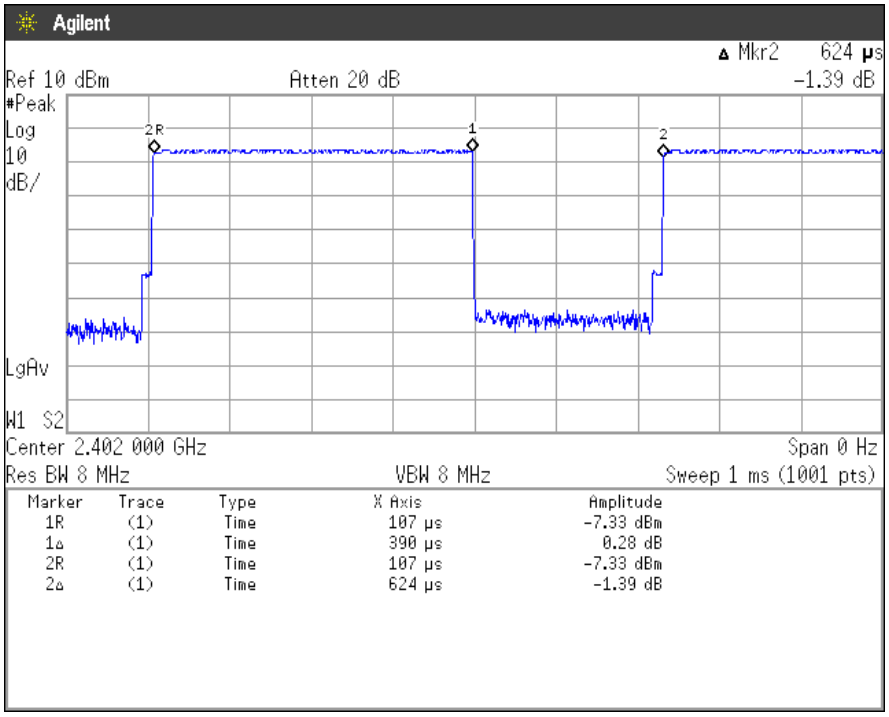
Equipment	Company	Model No.	Serial No.	Cal. Due	Cal. Date
EMI Receiver	ROHDE&SCHWARZ	ESCI	100765	30-Sep-2021	28-Sep-2020
Attenuator	HUBER+SUHNER	6810.01.A	N/A (S411)	31-Dec-2021	15-Dec-2020
Line impedance stabilization network	Kyoritsu Electrical Works, Ltd.	TNW-407F2	12-17-110-2	30-Jun-2022	17-Jun-2021
Coaxial cable	FUJIKURA	5D-2W/4m	N/A (S350)	31-Dec-2021	15-Dec-2020
Coaxial cable	FUJIKURA	5D-2W/1m	N/A (S193)	31-Dec-2021	15-Dec-2020
Coaxial cable	HUBER+SUHNER	RG214/U/10m	N/A (S194)	31-Dec-2021	15-Dec-2020
PC	DELL	DIMENSION	75465BX	N/A	N/A
Software	TOYO Corporation	EP5/CE-AJ	0611193/V5.4.11	N/A	N/A

*: The calibrations of the above equipment are traceable to NIST or equivalent standards of the reference organizations.

Japan

Appendix B. Duty Cycle

[Plot & Calculation]



Duty Cycle = Ton / (Ton + Toff) = 390[µs] / (390[µs] + 234[µs]) = 62.5[%]