

TEST REPORT

Report number : JPD-TR-16003-0

Issue date : May 11, 2016

The device, as described herewith, was tested pursuant to applicable test procedure and complies with the requirements of;

FCC Part15 Subpart C IC RSS-247

The test results are traceable to the international or national standards.

Applicant	: Telepathy Japan Inc.
Equipment under test (EUT)	: Telepathy walker
Model number	: TPC008
FCC ID	: 2AF83TPC008
IC Certification number	: 20764-TPC008

Date of test : April 15, 18, 19, 21, 22, 2016
Test place : TÜV SÜD Zacta Ltd. Yonezawa Testing Center
4149-7 Hachimanpara 5-chome
Yonezawa-shi Yamagata 992-1128 Japan
Phone: +81-238-28-2880 Fax: +81-238-28-2888
Test results : Complied

The results in this report are applicable only to the equipment tested.
This report shall not be re-produced except in full without the written approval of TÜV SÜD Zacta Ltd.
This test report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

Tested by : Kazunori Saito
Kazunori Saito

Tested by : Taiki Watanabe
Taiki Watanabe

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Manager of EMC Technical Department

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1. Summary of Test

1.1 Purpose of test

It is the original test in order to verify conformance to FCC Part 15 Subpart C and IC RSS-247.

1.2 Standards

CFR47 FCC Part 15 Subpart C
IC RSS-247

1.2.1 Test Methods

ANSI C63.10-2013, KDB558074 D01 DTS Meas Guidance v03r05

1.2.2 Deviation from standards

None

1.3 List of applied test to the EUT

FCC Section	IC Section	Test items	Condition	Result
15.247(a)(2)	RSS-247 5.2(1)	6dB Bandwidth	Conducted	PASS
15.247(b)(3)	RSS-247 5.4(4)	Maximum Peak Output Power	Conducted	PASS
15.247(d)	RSS-247 5.5	Band Edge Compliance of RF Conducted Emissions	Conducted	PASS
15.247(d) 15.205 15.209	RSS-247 5.5	Spurious Emissions	Conducted Radiated	PASS
15.247(d) 15.205 15.209	RSS-Gen 8.9	Restricted Bands of Operation	Radiated	PASS
15.247(e)	RSS-247 5.2(2)	Transmitter Power Spectral Density	Conducted	PASS
15.207	RSS-Gen 8.8	AC Power Line Conducted Emissions	Conducted	PASS

1.3.1 Test set up

Table-Top

1.4 Modification to the EUT by laboratory

None

2. Equipment Under Test

2.1 General Description of equipment

EUT is the Wearable device.

2.2 EUT information

Applicant	: Telepathy Japan Inc. Nihonbasi Ningyocho 1-7-10, Tsukakoshi bldg. 8F, Chuo-ku, Tokyo. 103-0013 Japan Phone: +81-70-5548-2887
Equipment under test	: Telepathy walker
Trade name	: Telepathy
Model number	: TPC008
Serial number	: N/A
EUT condition	: Pre-Production
Power ratings	: Battery: DC 3.7V
Size	: (W) 72× (D) 137 × (H) 21 mm / in use (W) 42× (D) 120 × (H) 21 mm /Portable form
Environment	: Indoor and Outdoor use
Thermal limitation	: 5°C to 45°C
RF Specification Protocol	: Bluetooth 4.0
Frequency range	: 2402MHz-2480MHz
Number of RF Channels	: 40 Channels
Modulation method/ Data rate	: GFSK (1Mbps)
Channel separation	: 2MHz
Conducted power	: 4.989mW
Antenna type	: Internal antenna
Antenna gain	: 3.0dBi

2.3 Variation of the family model(s)

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	1Mbps

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 Z axis and the worst case recorded.

2.6 Operating flow

[Tx mode]

- i) Test program setup to the RFTestTool, VER: 4.7.
- ii) Select a Test mode.
Operating frequency: Channel Low: 2402MHz, Channel Middle: 2440MHz, Channel High: 2480MHz.
- iii) Start test mode.

[Rx mode]

- i) Test program setup to the RFTestTool, VER: 4.7.
- ii) Select a Test mode.
Operating frequency: Channel Low: 2402MHz, Channel Middle: 2440MHz, Channel High: 2480MHz.
- iii) Start test mode.

3. Configuration of equipment

3.1 Equipment(s) used

No.	Equipment	Company	Model No.	Serial No.	FCC ID / DoC	Comment
1	Wearable device	Telepathy	TPC008	N/A	2AF83TPC008	EUT
2	AC Adapter	Telepathy	PSAA10A-050Q	N/A	N/A	*

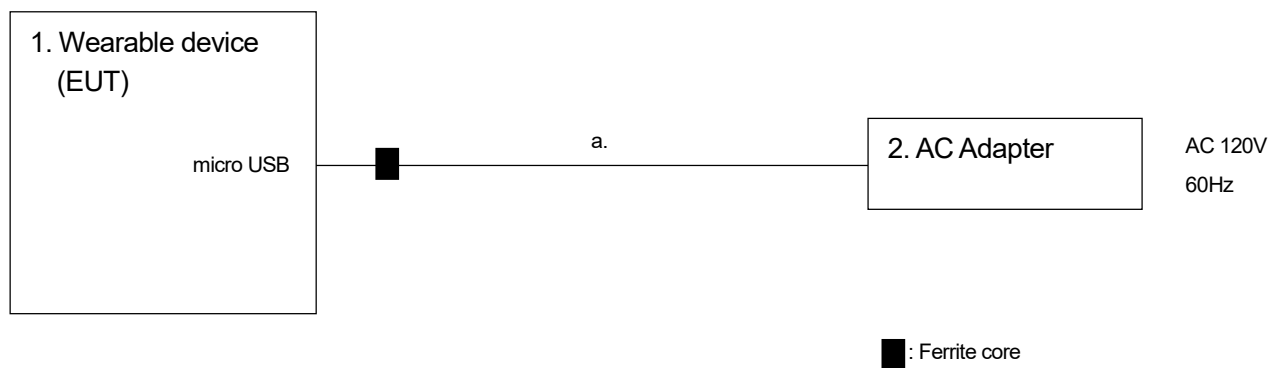
*: AC power line Conducted Emission Test.

3.2 Cable(s) used

No.	Cable	Length[m]	Shield	Connector	Comment
a	Micro USB cable(for AC Adapter)	0.9	No	Metal	*

*: AC power line Conducted Emission Test.

3.3 System configuration



Note1: Numbers assigned to equipment or cables on this diagram correspond to the list in "3.1 Equipment(s) used" and "3.2 Cable(s) used".

Note2: One ferrite core of DC cable (No.a) is accessory of AC adapter (No.2).

4. 6dB Bandwidth / 99% Bandwidth

4.1 Measurement procedure

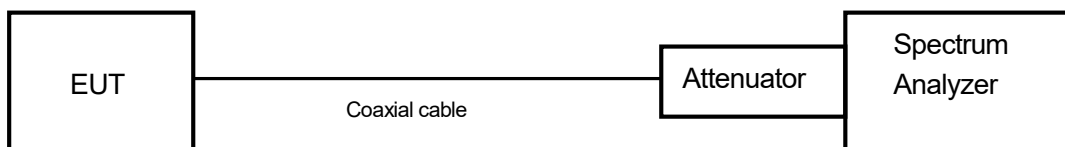
[FCC 15.247(a)(2), RSS-247 5.2.(1), KDB558074 D01 v03r05, Section 8.2]

The bandwidth at 6dB down from the highest inband spectral density 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) RBW = 100kHz.
- b) VBW $\geq 3 \times$ RBW.
- c) Sweep time = auto-couple.
- d) Detector = peak.
- e) Trace mode = max hold.

- Test configuration



4.2 Limit

The minimum permissible 6dB bandwidth is 500kHz.
There is no limit of 99% bandwidth.

4.3 Measurement result

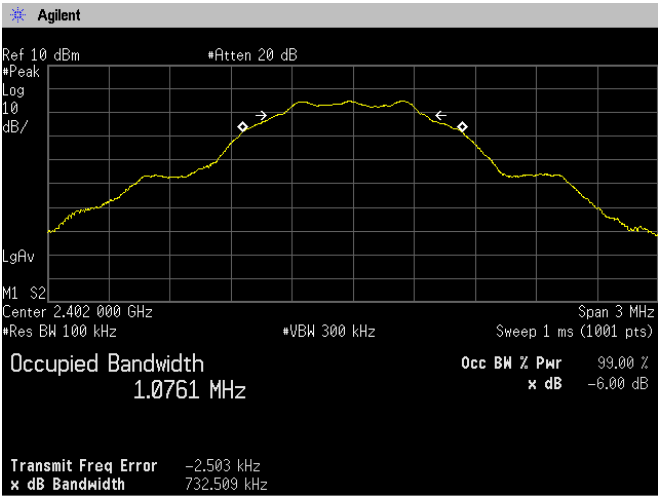
Date : April 19, 2016
 Temperature : 23.8 [°C]
 Humidity : 30.2 [%]
 Test place : Shielded room No.4

Test engineer : Taiki Watanabe

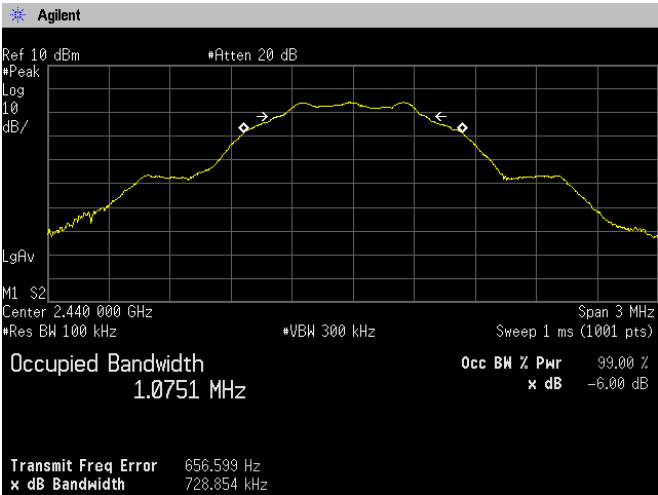
Channel	Frequency [MHz]	6dB bandwidth [MHz]	99% bandwidth [MHz]
Low	2402	0.733	1.076
Middle	2440	0.729	1.075
High	2480	0.735	1.077

4.4 Trace data

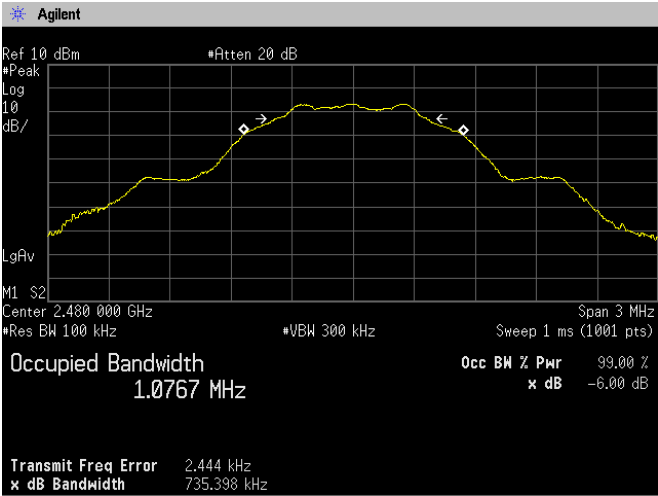
Channel Low



Channel Middle



Channel High



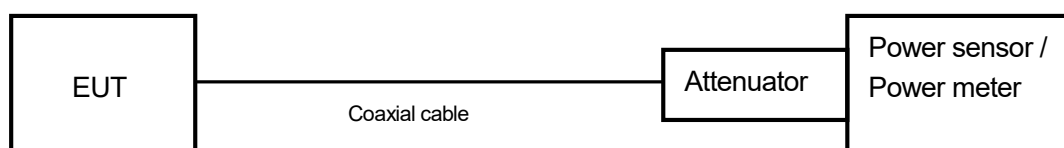
5. Maximum Peak Output Power

5.1 Measurement procedure

[FCC 15.247(b)(3), RSS-247 5.4(4), KDB558074 D01 v03r05, Section 9.1.2]

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



5.2 Limit

1W (1000mW) or less

5.3 Measurement result

Date : April 19, 2016

Temperature : 23.8 [°C]

Humidity : 30.2 [%]

Test place : Shielded room No.4

Test engineer :

Taiki Watanabe

Battery Full

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Peak Output Power (mW)	Limit (mW)	Result
Low	2402	-3.54	10.52	6.98	4.989	≤1000	PASS
Middle	2440	-3.93	10.52	6.59	4.560	≤1000	PASS
High	2480	-5.21	10.52	5.31	3.396	≤1000	PASS

Calculation;

Reading (dBm) + Factor (dB) = Level (dBm)

$10\log P = \text{Level (dBm)}$

$P = 10^{(\text{Maximum Peak Output Power} / 10)} \text{ (mW)}$

6. Band Edge Compliance of RF Conducted Emissions

6.1 Measurement procedure

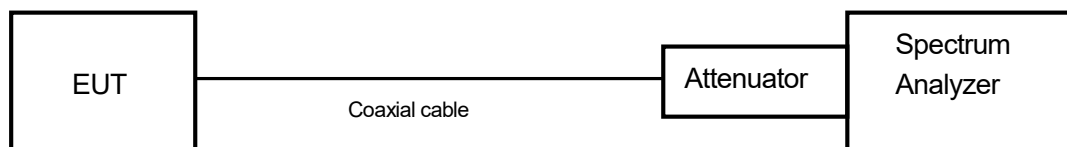
[FCC 15.247(d), RSS-247 5.5, KDB558074 D01 v03r05, Section 11.0]

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 $\geq 3 \times$ RBW
- d) Sweep time = auto-couple.
- e) Detector = peak.
- f) Trace mode = max hold.

- Test configuration



6.2 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.

6.3 Measurement result

Date : April 19, 2016

Temperature : 23.8 [°C]

Humidity : 30.2 [%]

Test place : Shielded room No.4

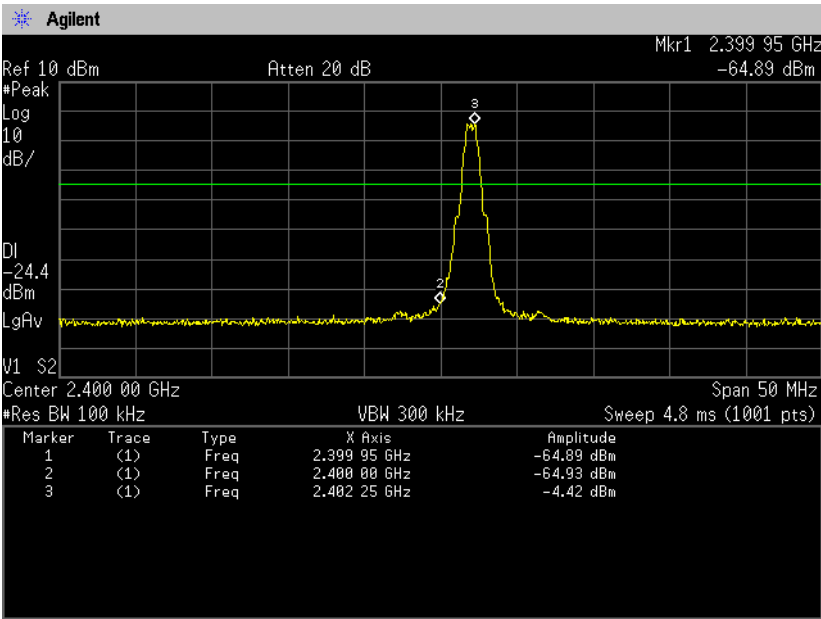
Test engineer :

Taiki Watanabe

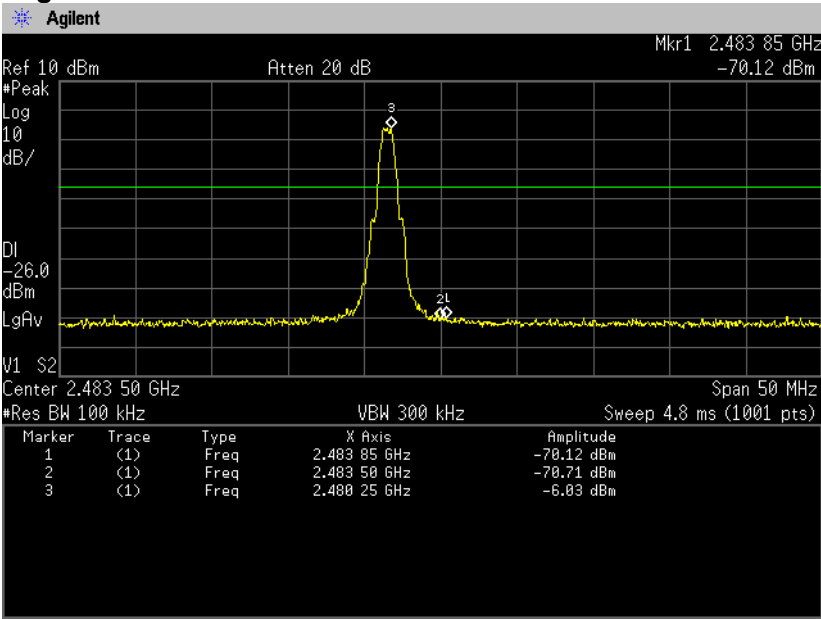
Channel	Frequency (MHz)	RF Power Level (dBm)	Band-edge Frequency (MHz)	Band-edge Level (dBm)	Difference Level (dBm)	Limit (dBm)	Result
Low	2402.00	-4.42	2399.95	-64.89	60.47	At least 20dB below from peak of RF	PASS
High	2480.00	-6.03	2483.85	-70.12	64.09	At least 20dB below from peak of RF	PASS

6.4 Trace data

Channel Low



Channel High



7. Spurious emissions - Conducted -

7.1 Measurement procedure

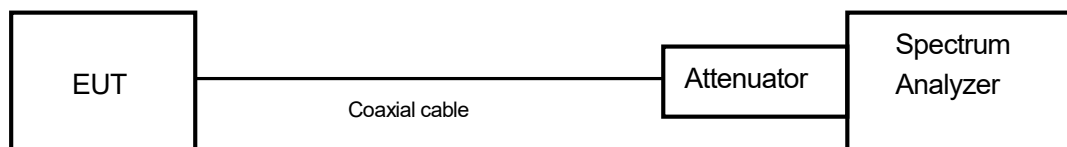
[FCC 15.247(d), RSS-247 5.5, KDB558074 D01 v03r05, Section 11.0]

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 $\geq$ RBW.
- d) Sweep time = auto-couple.
- e) Detector = peak.
- f) Trace mode = max hold.

- Test configuration



7.2 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.

7.3 Measurement result

Date : April 19, 2016

Temperature : 23.8 [°C]

Humidity : 30.2 [%]

Test place : Shielded room No.4

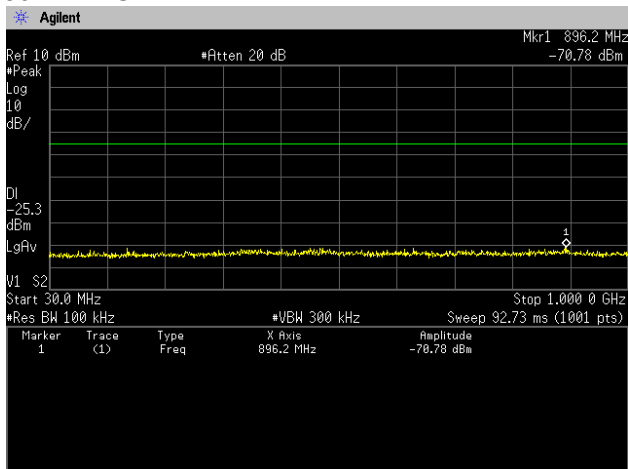
Test engineer :

Taiki Watanabe

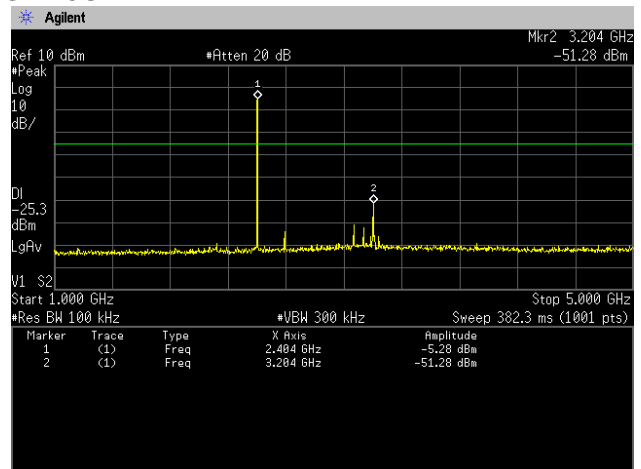
Channel	Frequency [MHz]	Limit [dB]	Results Chart	Result
Low	2402	At least 20dB below from peak of RF	See the trace Data	PASS
Middle	2440	At least 20dB below from peak of RF	See the trace Data	PASS
High	2480	At least 20dB below from peak of RF	See the trace Data	PASS

7.4 Trace data

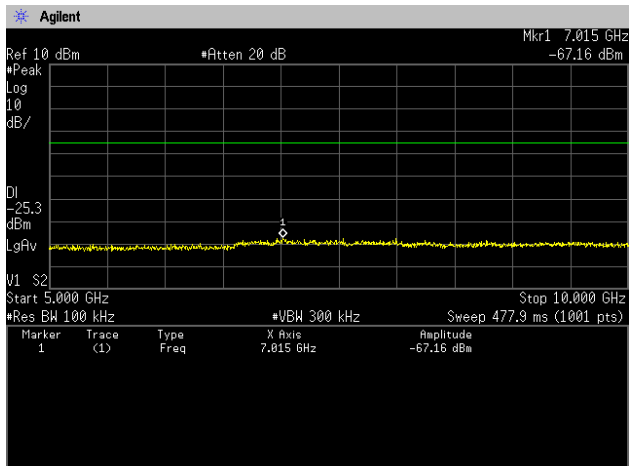
Channel Low 30MHz-1GHz



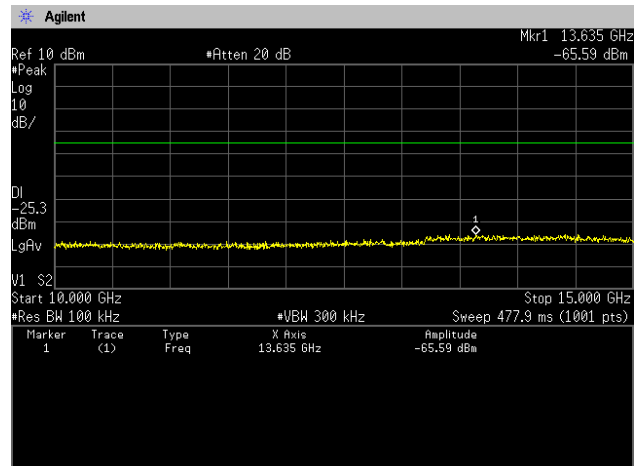
1GHz-5GHz



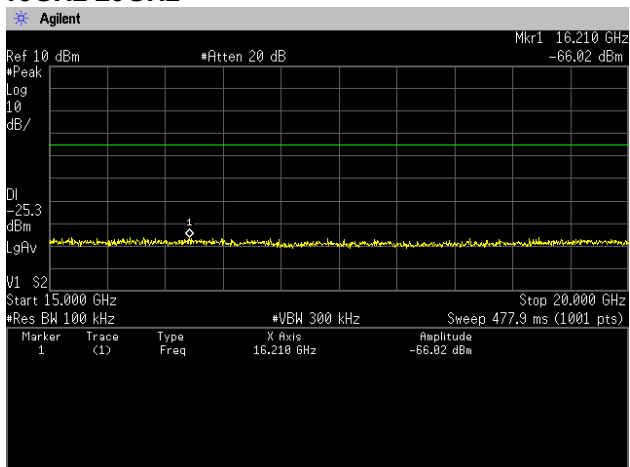
5GHz-10GHz



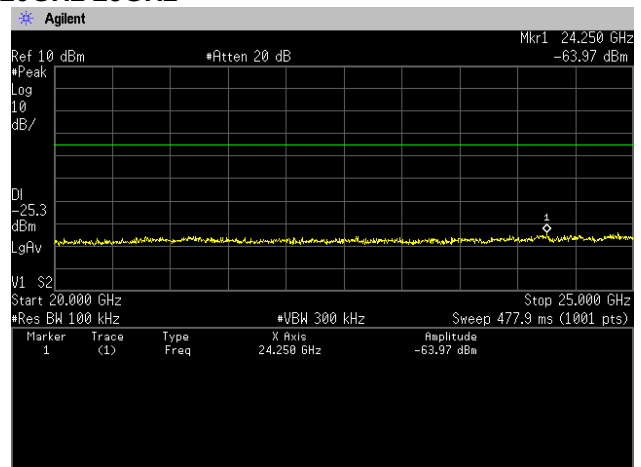
10GHz-15GHz



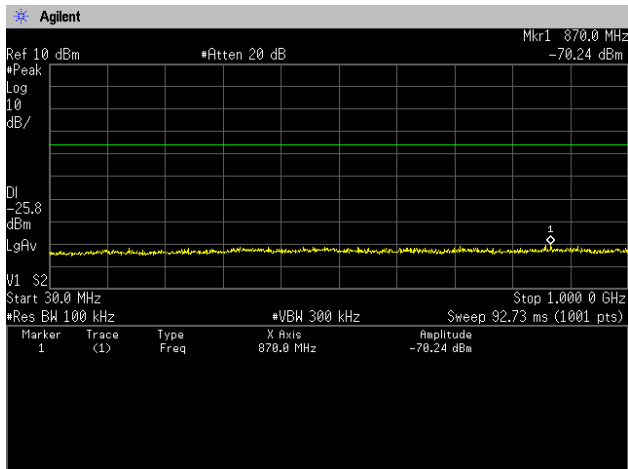
15GHz-20GHz



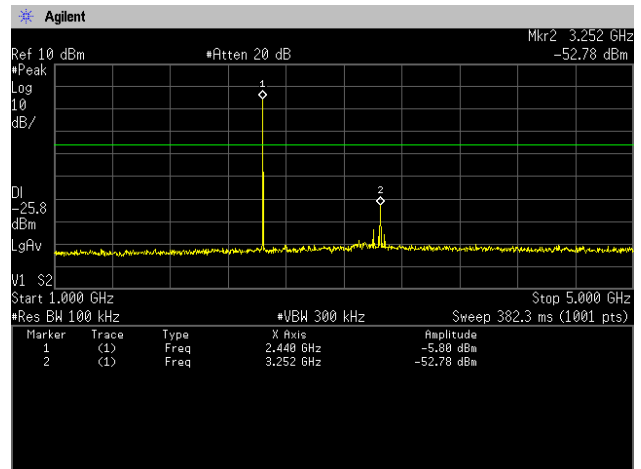
20GHz-25GHz



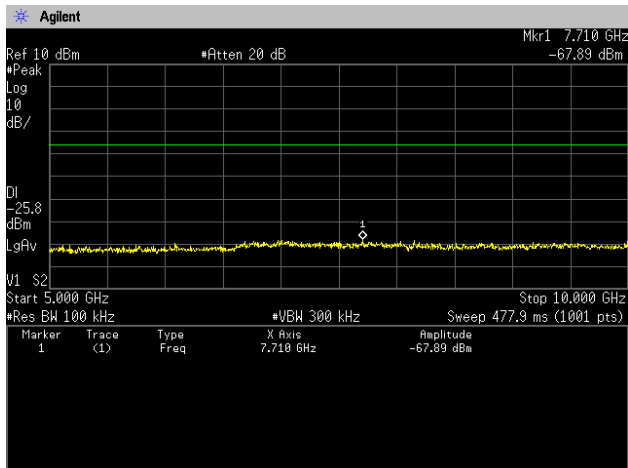
Channel Middle 30MHz-1GHz



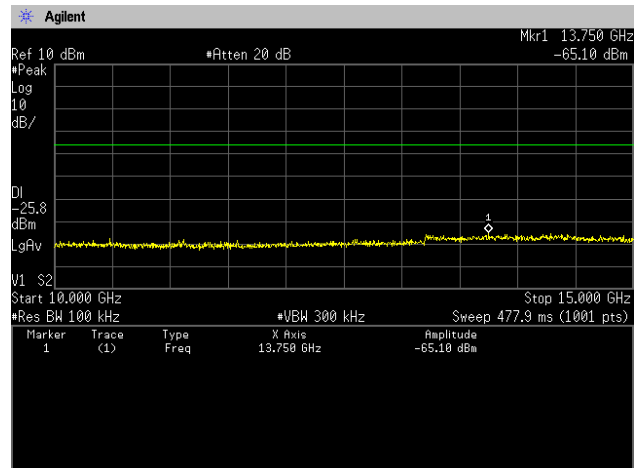
1GHz-5GHz



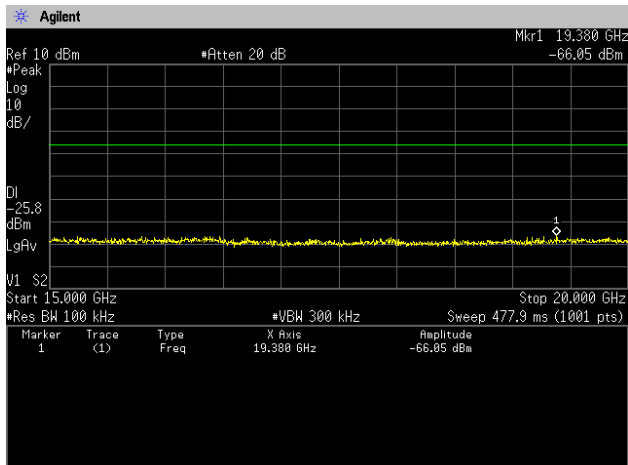
5GHz-10GHz



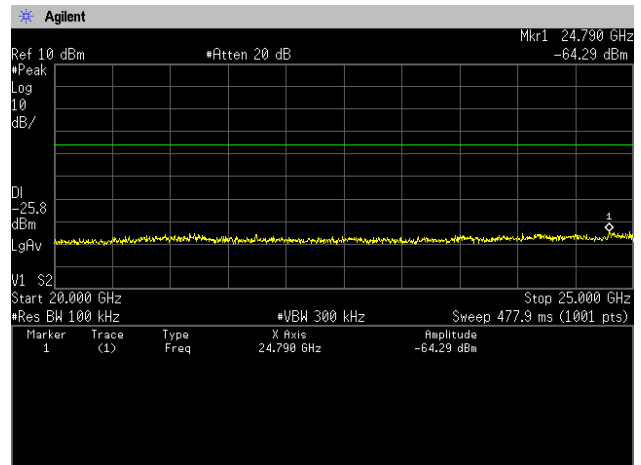
10GHz-15GHz



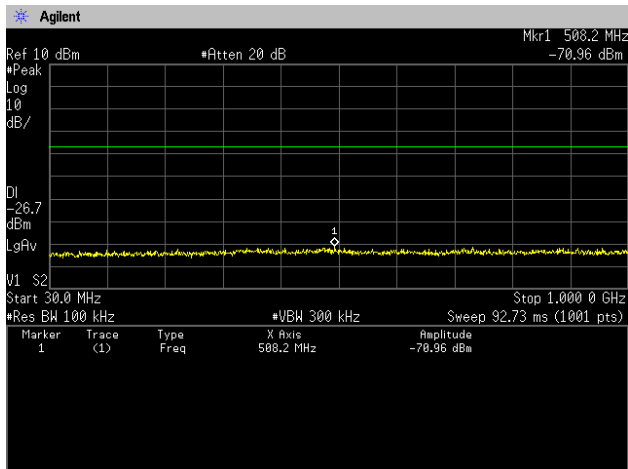
15GHz-20GHz



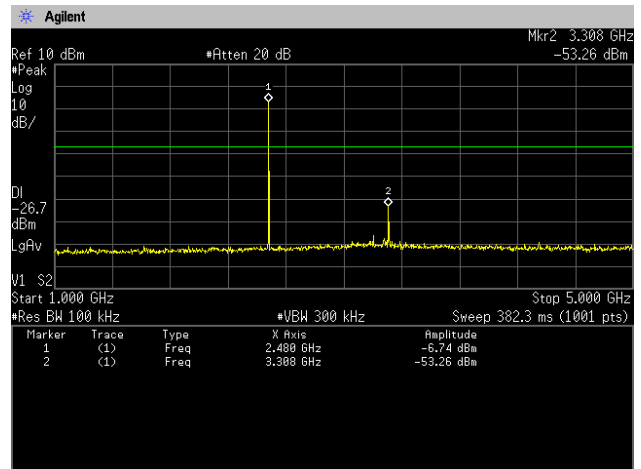
20GHz-25GHz



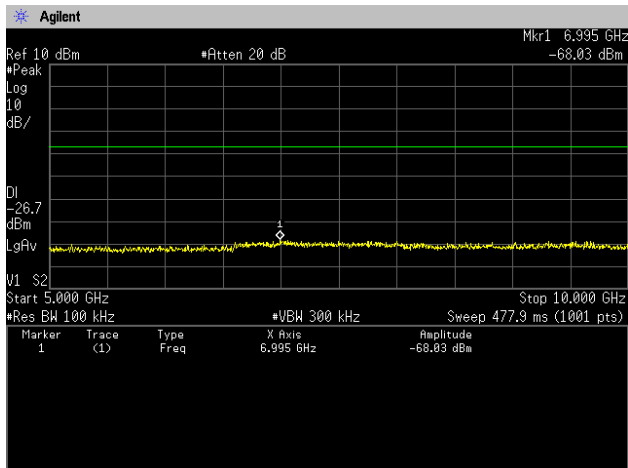
Channel High 30MHz-1GHz



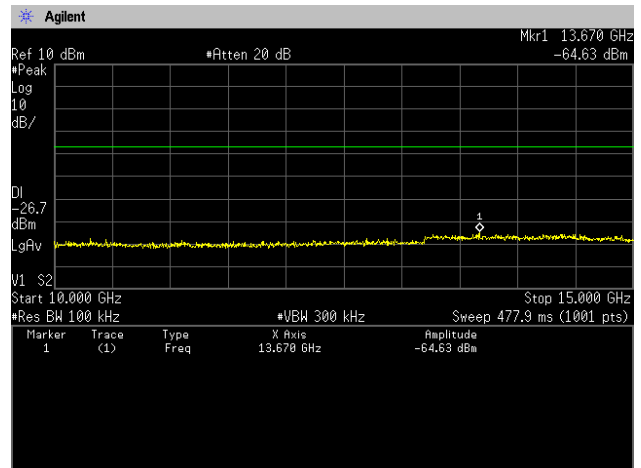
1GHz-5GHz



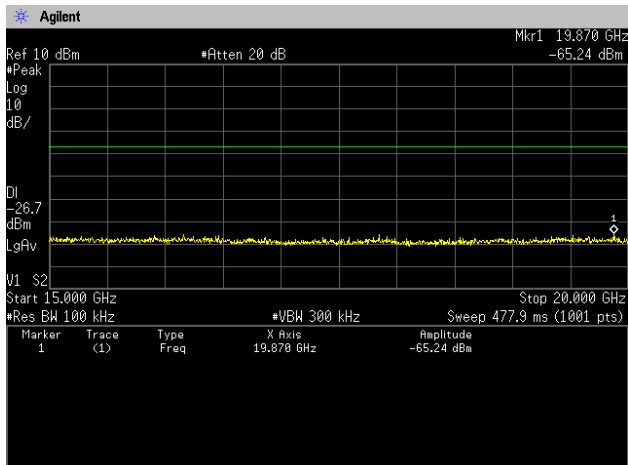
5GHz-10GHz



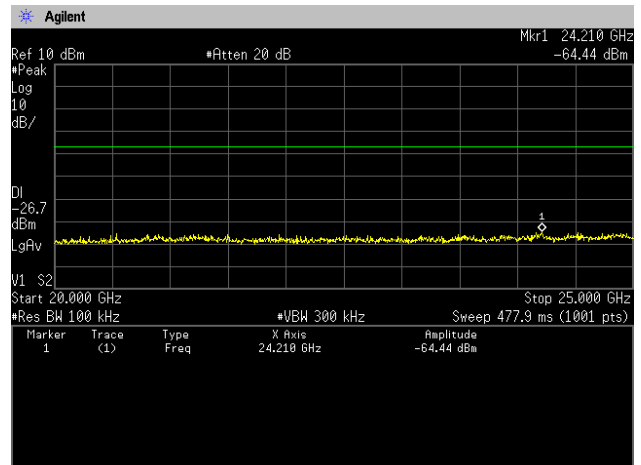
10GHz-15GHz



15GHz-20GHz



20GHz-25GHz



8. Spurious Emissions - Radiated -

8.1 Measurement procedure

[FCC 15.247(d), 15.205, 15.209, RSS-Gen 8.9, KDB 558074 D01 v03r05, Section 12.0]

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)0.6m × (D)0.6m × (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

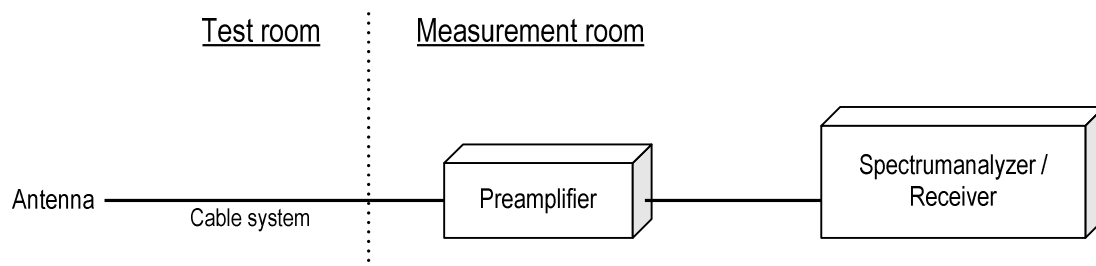
Average Measurement Setting [VBW]

Mode	Duty Cycle (%)	T _{on} (us)	T _{off} (us)	1/T _{on} (kHz)	Determined VBW Setting
Bluetooth 4.0 LE	62.3	390	236	2.564	3kHz

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 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



8.2 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

8.3 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.

8.4 Test data

Date : April 15, 2016
Temperature : 22.0 [°C]
Humidity : 37.8 [%]
Test place : 3m Semi-anechoic chamber

Test engineer :

Kazunori Saito

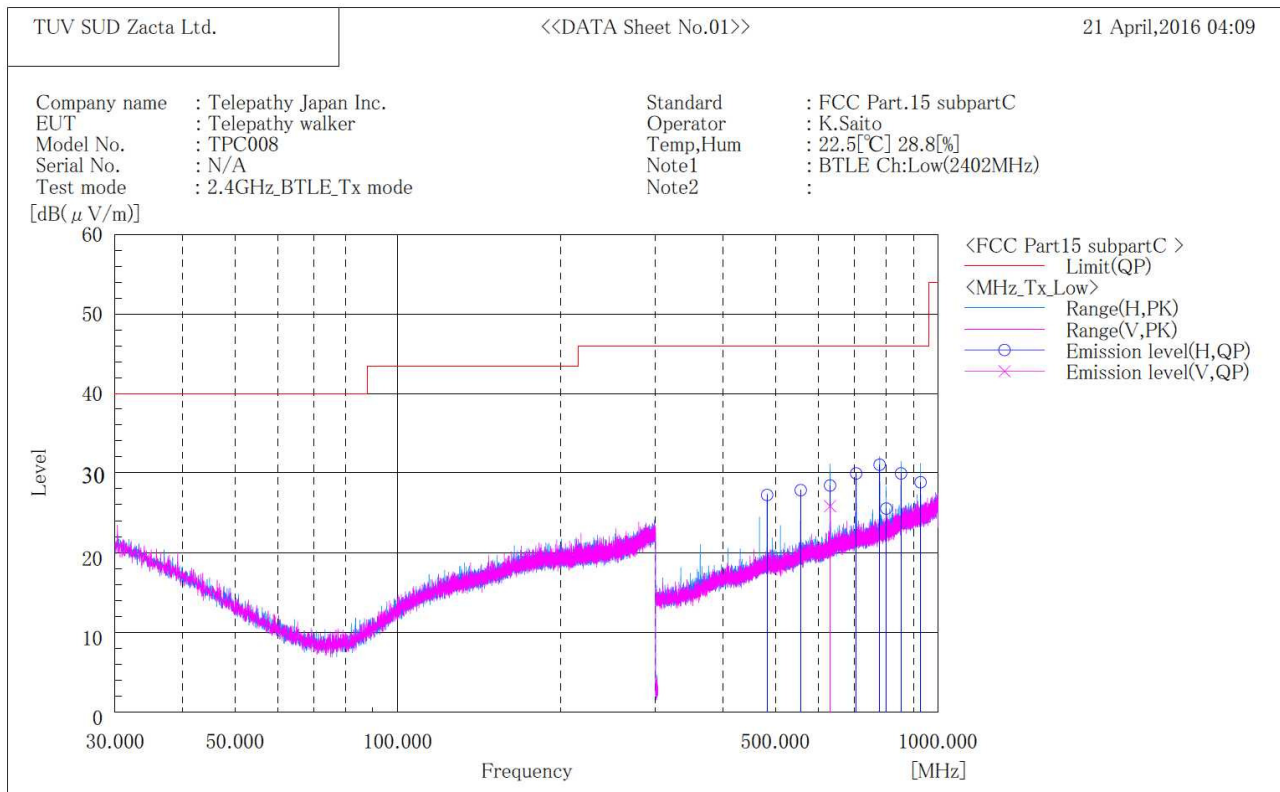
Date : April 21, 2016
Temperature : 22.5 [°C]
Humidity : 28.8 [%]
Test place : 3m Semi-anechoic chamber

Test engineer :

Kazunori Saito

8.4.1 Transmission mode

Channel Low BELOW 1GHz



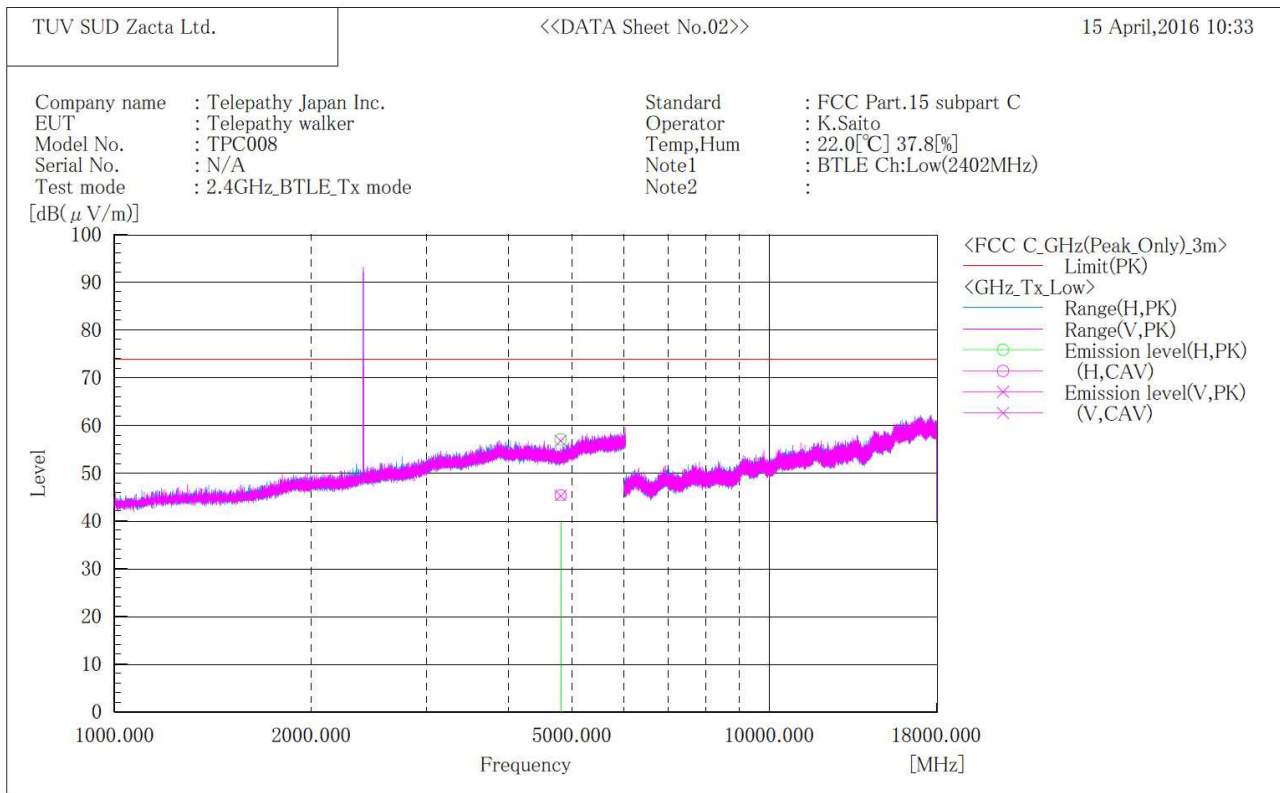
Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c. f [dB(1/m)]	Result QP [dB(μV/m)]	Limit QP [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]	Remark
1	482.600	H	33.7	-6.5	27.2	46.0	18.8	200.0	182.0	
2	556.900	H	33.1	-5.3	27.8	46.0	18.2	400.0	26.0	
3	631.100	H	32.6	-4.2	28.4	46.0	17.6	350.0	348.0	
4	631.100	V	30.0	-4.2	25.8	46.0	20.2	150.0	319.0	
5	705.500	H	33.0	-3.1	29.9	46.0	16.1	100.0	353.0	
6	779.500	H	33.5	-2.5	31.0	46.0	15.0	100.0	353.0	
7	802.000	H	27.6	-2.1	25.5	46.0	20.5	100.0	0.0	
8	853.900	H	30.8	-0.9	29.9	46.0	16.1	100.0	0.0	
9	928.000	H	28.8	0.0	28.8	46.0	17.2	100.0	0.0	

Note:

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

Channel Low ABOVE 1GHz



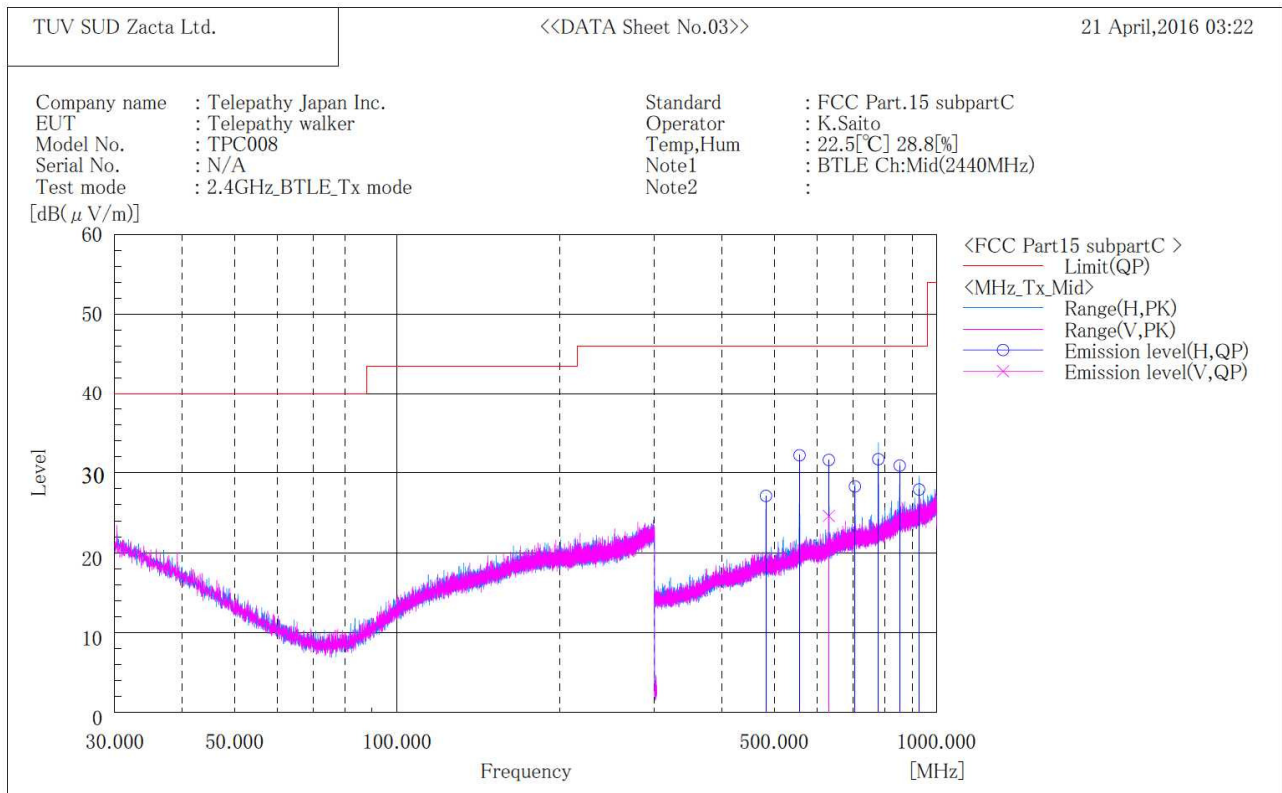
Final Result

No.	Frequency [MHz]	(P)	Reading PK [dB(μV)]	Reading CAV [dB(μV)]	c. f [dB(1/m)]	Result PK [dB(μV/m)]	Result CAV [dB(μV/m)]	Limit PK [dB(μV/m)]	Margin PK [dB]	Margin CAV [dB]	Height [cm]	Angle [°]	Remark
1	4804.000	H	48.8	37.1	8.3	57.1	45.4	74.0	16.9	8.6	123.0	36.0	
2	4804.000	V	48.5	37.0	8.3	56.8	45.3	74.0	17.2	8.7	184.0	28.0	

Note:

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

Channel Middle BELOW 1GHz



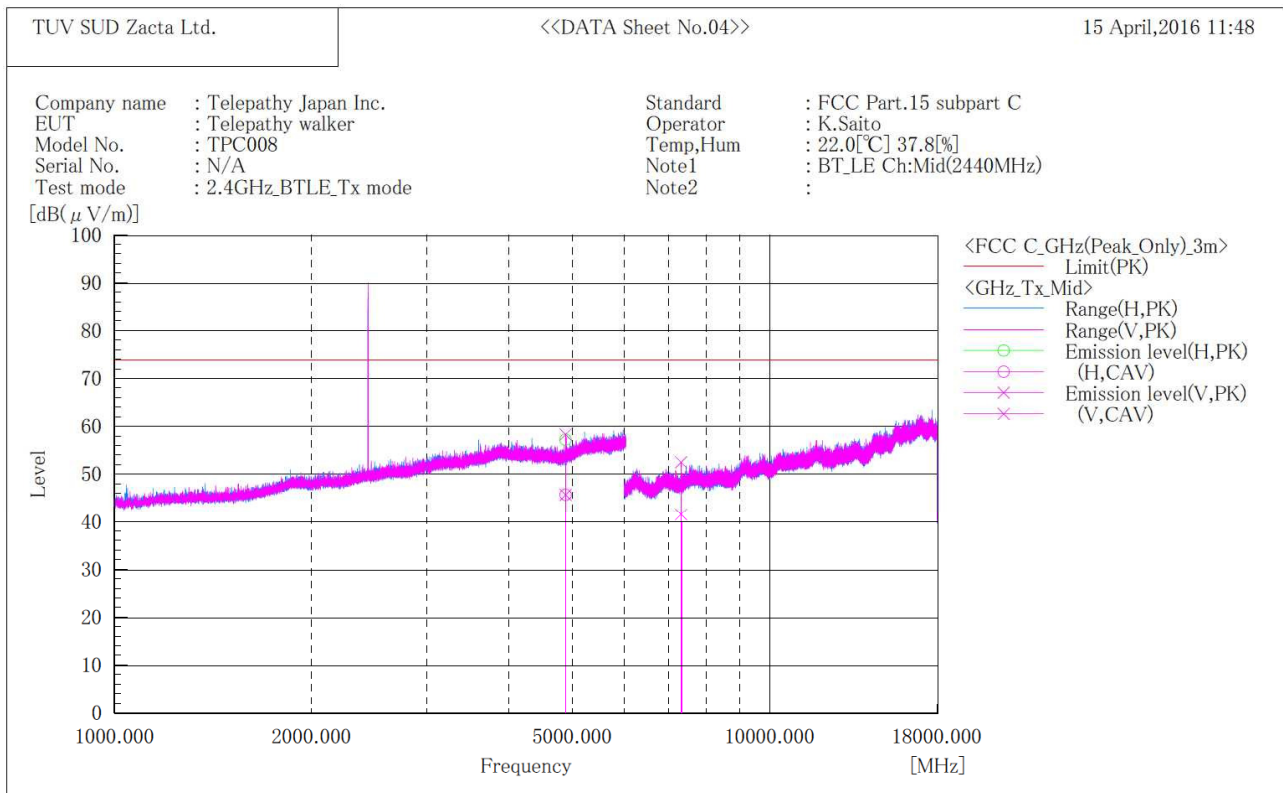
Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c. f [dB(1/m)]	Result QP [dB(μV/m)]	Limit QP [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]	Remark
1	482.700	H	33.6	-6.5	27.1	46.0	18.9	200.0	2.0	
2	556.900	H	37.5	-5.3	32.2	46.0	13.8	200.0	2.0	
3	631.100	H	35.8	-4.2	31.6	46.0	14.4	300.0	197.0	
4	631.200	V	28.8	-4.2	24.6	46.0	21.4	300.0	264.0	
5	705.400	H	31.4	-3.1	28.3	46.0	17.7	300.0	202.0	
6	779.600	H	34.2	-2.5	31.7	46.0	14.3	200.0	0.0	
7	853.800	H	31.8	-0.9	30.9	46.0	15.1	100.0	183.0	
8	927.700	H	27.9	0.0	27.9	46.0	18.1	100.0	182.0	

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.

Channel Middle ABOVE 1GHz



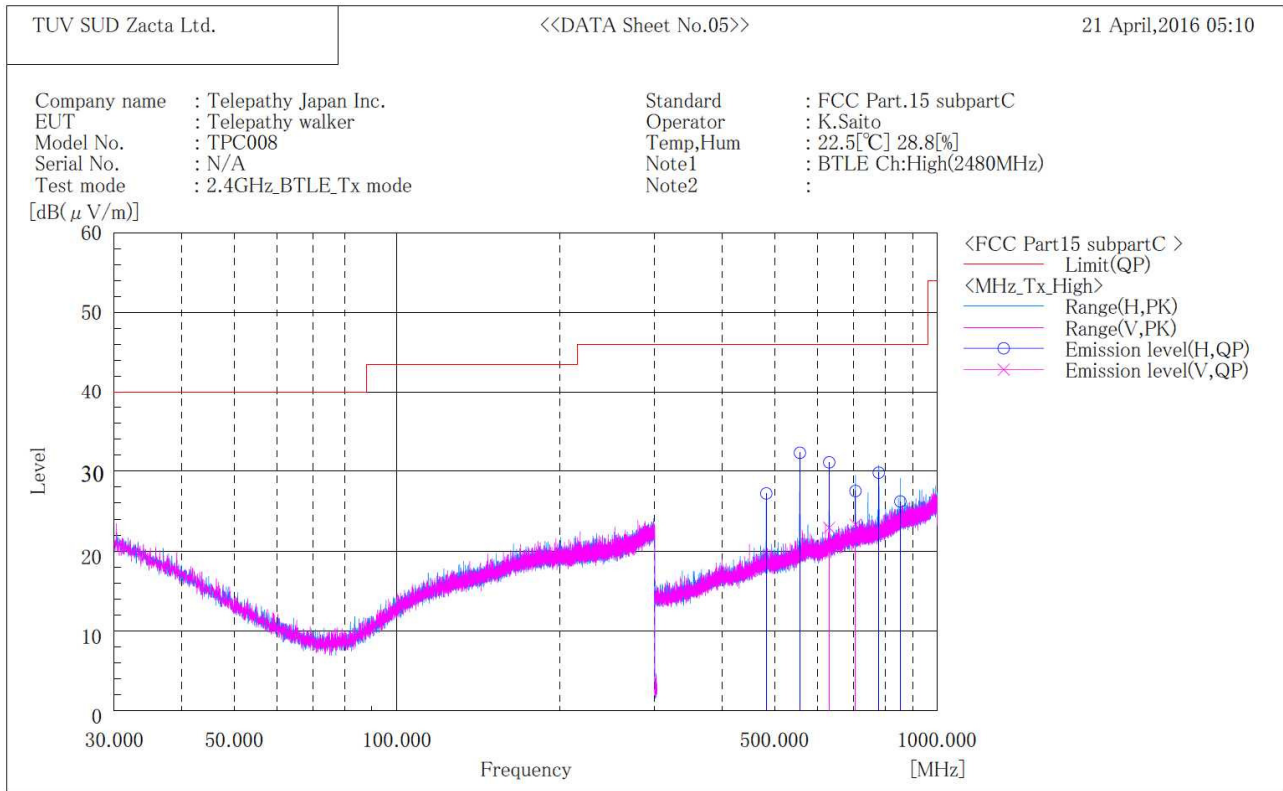
Final Result

No.	Frequency [MHz]	(P)	Reading PK [dB(μV)]	Reading CAV [dB(μV)]	c.f [dB(1/m)]	Result PK [dB(μV/m)]	Result CAV [dB(μV/m)]	Limit PK [dB(μV/m)]	Margin PK [dB]	Margin CAV [dB]	Height [cm]	Angle [°]	Remark
1	4880.000	H	48.4	36.9	8.8	57.2	45.7	74.0	16.8	8.3	137.0	48.0	
2	4880.000	V	49.5	36.9	8.8	58.3	45.7	74.0	15.7	8.3	161.0	158.0	
3	7320.000	V	47.7	36.7	4.8	52.5	41.5	74.0	21.5	12.5	151.0	132.0	

Note:

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

Channel High BELOW 1GHz



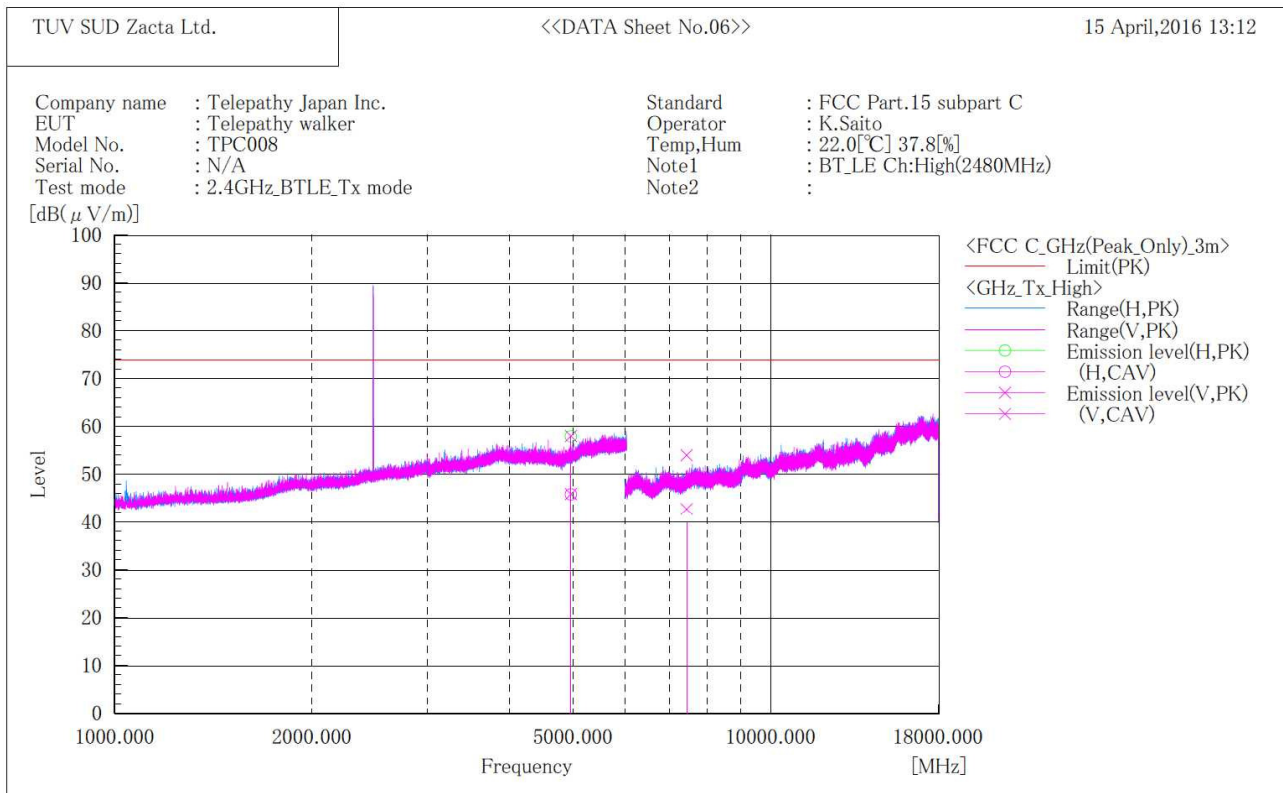
Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c. f [dB(1/m)]	Result QP [dB(μV/m)]	Limit QP [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]	Remark
1	482.600	H	33.7	-6.5	27.2	46.0	18.8	200.0	10.0	
2	556.900	H	37.6	-5.3	32.3	46.0	13.7	200.0	10.0	
3	630.800	V	27.1	-4.2	22.9	46.0	23.1	150.0	308.0	
4	631.100	H	35.3	-4.2	31.1	46.0	14.9	300.0	170.0	
5	705.500	V	26.4	-3.1	23.3	46.0	22.7	100.0	151.0	
6	705.600	H	30.6	-3.1	27.5	46.0	18.5	300.0	170.0	
7	779.500	H	32.3	-2.5	29.8	46.0	16.2	200.0	8.0	
8	854.500	H	27.1	-0.9	26.2	46.0	19.8	200.0	8.0	

Note:

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

Channel High ABOVE 1GHz



Final Result

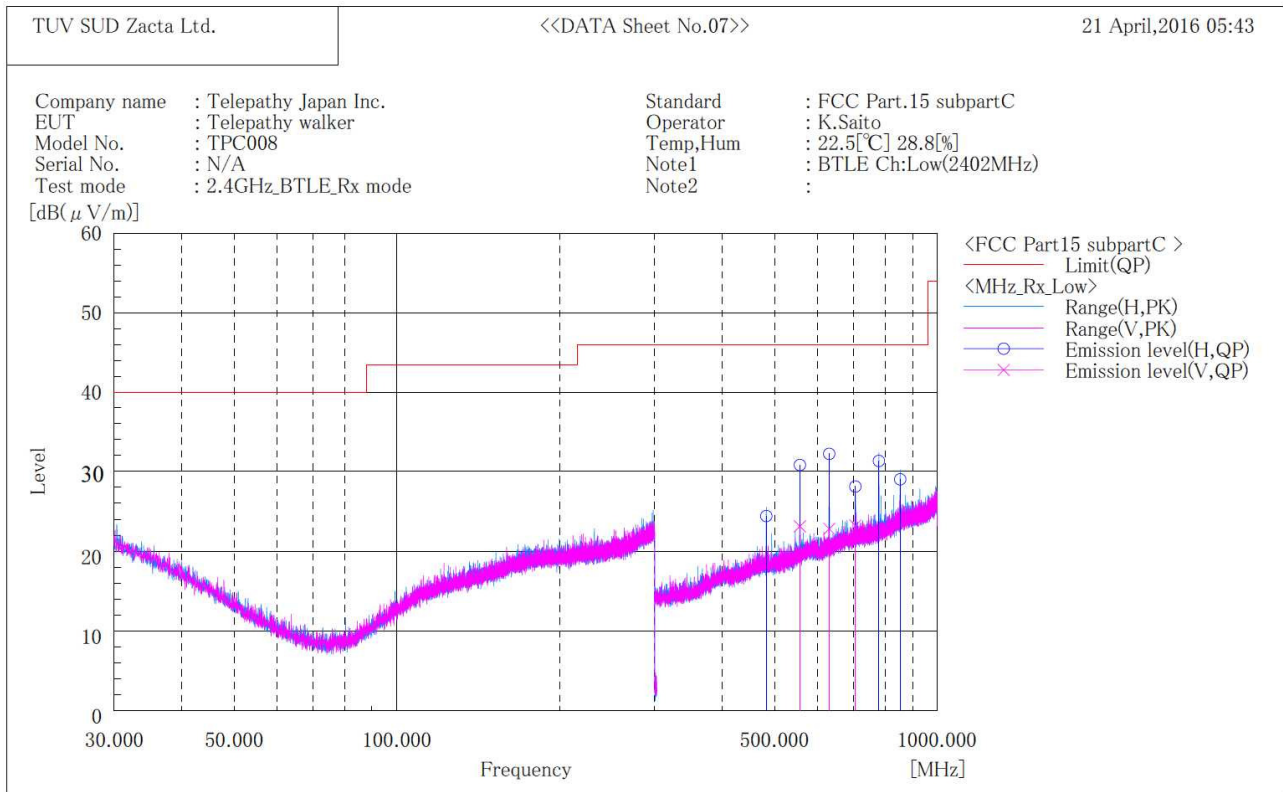
No.	Frequency [MHz]	(P)	Reading PK [dB(μV)]	Reading CAV [dB(μV)]	c.f [dB(1/m)]	Result PK [dB(μV/m)]	Result CAV [dB(μV/m)]	Limit PK [dB(μV/m)]	Margin PK [dB]	Margin CAV [dB]	Height [cm]	Angle [°]	Remark
1	4960.000	H	49.0	36.9	8.9	57.9	45.8	74.0	16.1	8.2	150.0	42.0	
2	4960.000	V	49.1	37.0	8.9	58.0	45.9	74.0	16.0	8.1	160.0	181.0	
3	7440.000	V	49.0	37.7	5.0	54.0	42.7	74.0	20.0	11.3	176.0	133.0	

Note:

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

8.4.2 Receive mode

Channel Low BELOW 1GHz



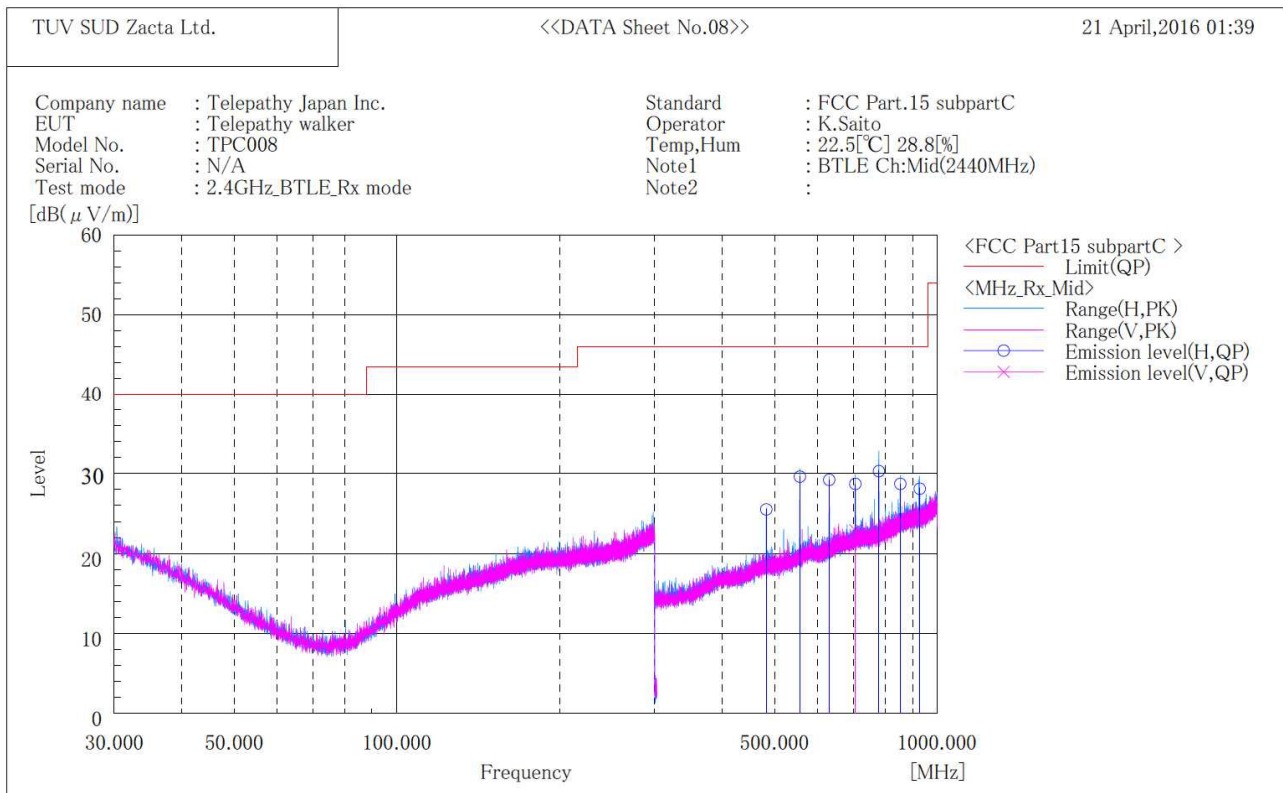
Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c. f [dB(1/m)]	Result QP [dB(μV/m)]	Limit QP [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]	Remark
1	482.600	H	30.9	-6.5	24.4	46.0	21.6	200.0	189.0	
2	556.900	H	36.1	-5.3	30.8	46.0	15.2	200.0	322.0	
3	556.900	V	28.4	-5.3	23.1	46.0	22.9	100.0	123.0	
4	631.100	H	36.4	-4.2	32.2	46.0	13.8	300.0	350.0	
5	631.200	V	27.0	-4.2	22.8	46.0	23.2	300.0	237.0	
6	705.300	V	26.3	-3.1	23.2	46.0	22.8	300.0	237.0	
7	705.500	H	31.2	-3.1	28.1	46.0	17.9	300.0	350.0	
8	779.800	H	33.8	-2.5	31.3	46.0	14.7	100.0	351.0	
9	853.700	H	29.9	-0.9	29.0	46.0	17.0	200.0	194.0	

Note:

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

Channel Middle BELOW 1GHz



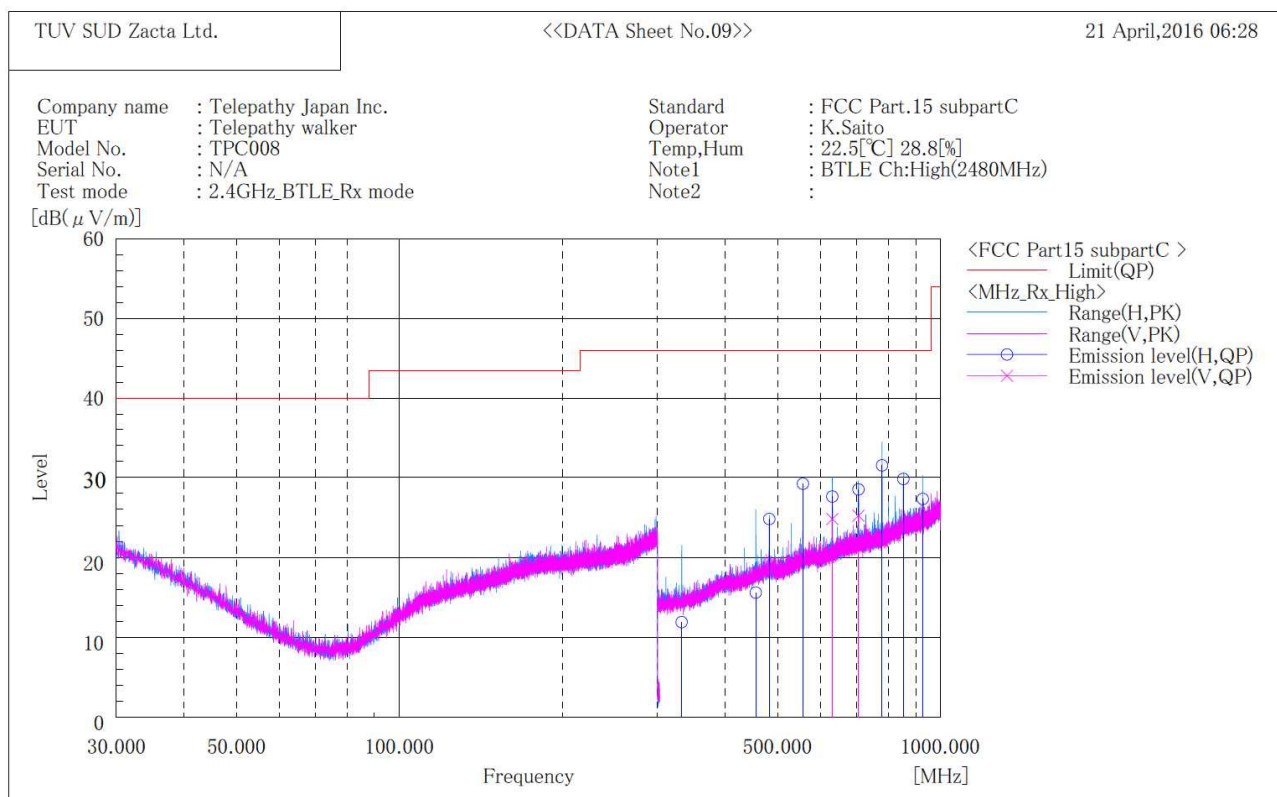
Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c. f [dB(1/m)]	Result QP [dB(μV/m)]	Limit QP [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]	Remark
1	928.200	H	28.1	0.0	28.1	46.0	17.9	100.0	163.0	
2	854.200	H	29.6	-0.9	28.7	46.0	17.3	100.0	159.0	
3	779.700	H	32.8	-2.5	30.3	46.0	15.7	100.0	36.0	
4	705.300	H	31.8	-3.1	28.7	46.0	17.3	100.0	159.0	
5	705.300	V	26.0	-3.1	22.9	46.0	23.1	100.0	135.0	
6	631.100	H	33.4	-4.2	29.2	46.0	16.8	300.0	169.0	
7	557.000	H	34.9	-5.3	29.6	46.0	16.4	200.0	9.0	
8	482.600	H	32.0	-6.5	25.5	46.0	20.5	200.0	135.0	

Note:

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

Channel High BELOW 1GHz



Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c. f [dB(1/m)]	Result QP [dB(μV/m)]	Limit QP [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]	Remark
1	455.800	H	22.7	-7.1	15.6	46.0	30.4	100.0	237.0	
2	482.600	H	31.3	-6.5	24.8	46.0	21.2	200.0	177.0	
3	556.900	H	34.5	-5.3	29.2	46.0	16.8	200.0	51.0	
4	631.100	V	29.0	-4.2	24.8	46.0	21.2	150.0	248.0	
5	631.200	H	31.8	-4.2	27.6	46.0	18.4	350.0	349.0	
6	705.400	V	28.3	-3.1	25.2	46.0	20.8	300.0	281.0	
7	705.500	H	31.6	-3.1	28.5	46.0	17.5	300.0	354.0	
8	779.800	H	34.0	-2.5	31.5	46.0	14.5	100.0	0.0	
9	853.800	H	30.7	-0.9	29.8	46.0	16.2	200.0	178.0	
10	927.600	H	27.3	0.0	27.3	46.0	18.7	100.0	354.0	
11	332.500	H	22.2	-10.3	11.9	46.0	34.1	100.0	237.0	

Note:

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

9. Restricted Band of Operation

9.1 Measurement procedure

[FCC 15.247(d), 15.205, 15.209, RSS-Gen 8.9, KDB 558074 D01 v03r05, Section 12.0]

Test was applied by following conditions.

Test method : ANSI C63.10
 Test place : 3m Semi-anechoic chamber
 EUT was placed on : Styrofoam table / (W)0.6m × (D)0.6m ×(H)1.5m
 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

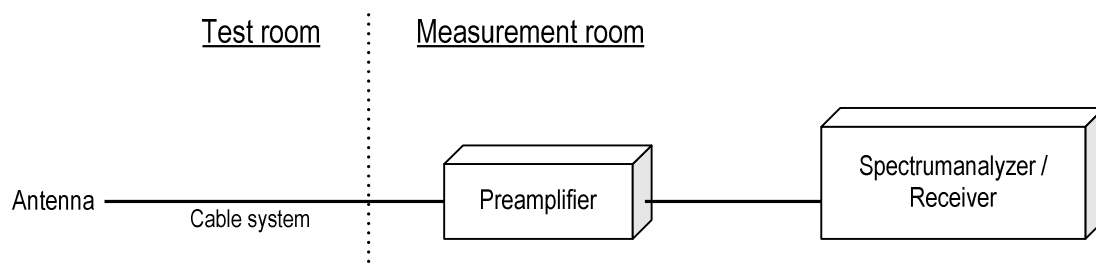
Average Measurement Setting [VBW]

Mode	Duty Cycle (%)	T _{on} (us)	T _{off} (us)	1/T _{on} (kHz)	Determined VBW Setting
Bluetooth 4.0 LE	62.3	390	236	2.564	3kHz

Radiated emission measurements are performed at 3m distance with the broadband antenna (Double ridged guide 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.

The EUT is Placed on a turntable, which is 0.8m 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



9.2 Limit

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

9.3 Measurement Result

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

9.4 Test data

Date : April 18, 2016

Temperature : 21.0 [°C]

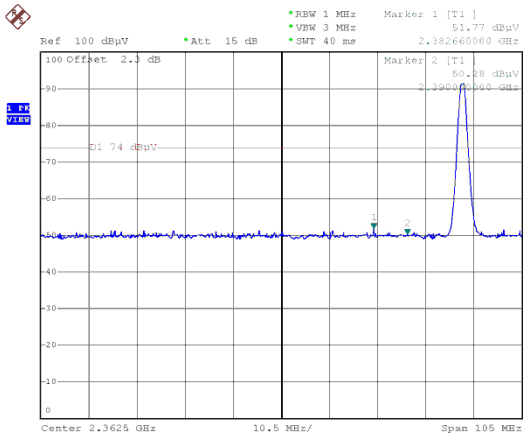
Humidity : 33.8 [%]

Test place : 3m Semi-anechoic chamber

Test engineer :

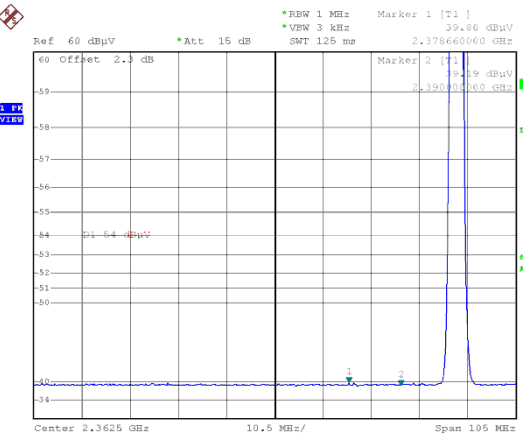
Kazunori Saito

**Channel Low
Horizontal
Peak**



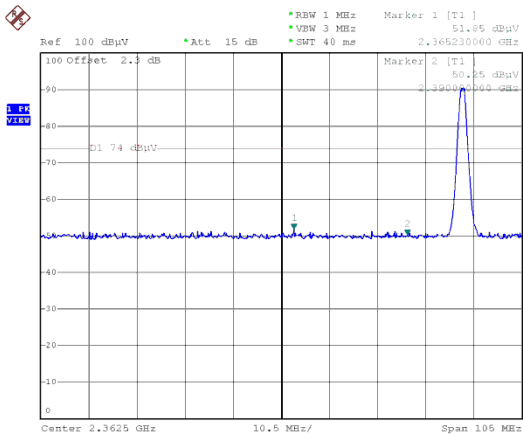
Date: 18.APR.2016 22:55:01

Average



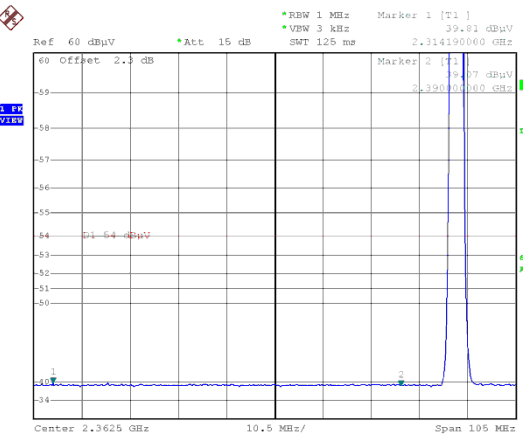
Date: 18.APR.2016 22:56:28

**Vertical
Peak**



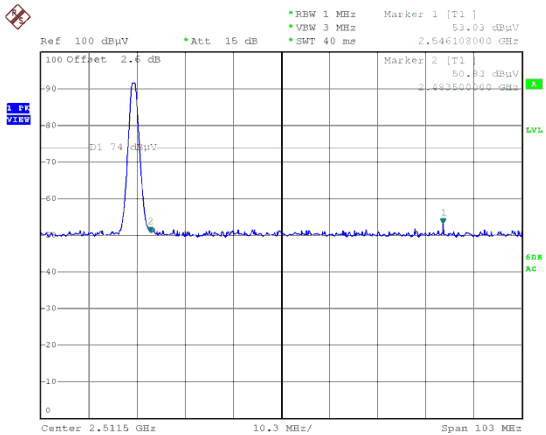
Date: 18.APR.2016 23:00:44

Average



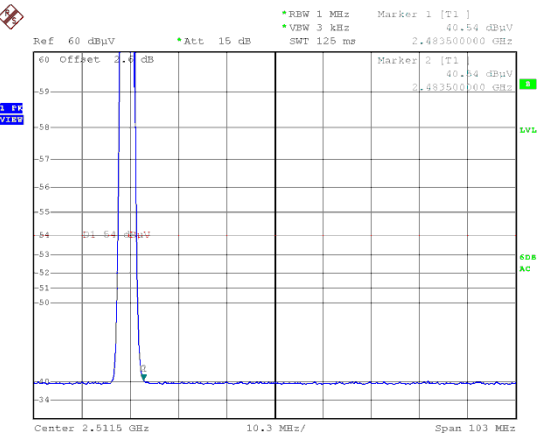
Date: 18.APR.2016 23:02:12

Channel High
Horizontal
Peak



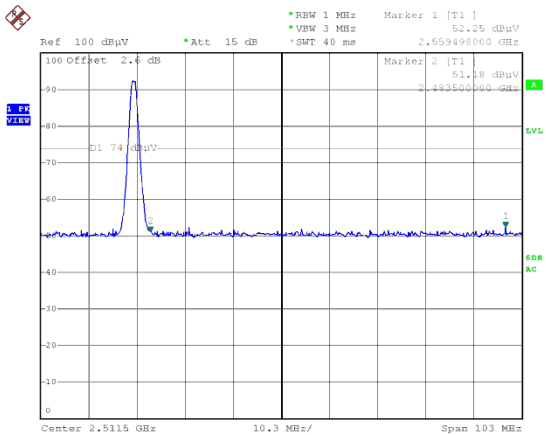
Date: 18.APR.2016 23:16:21

Average



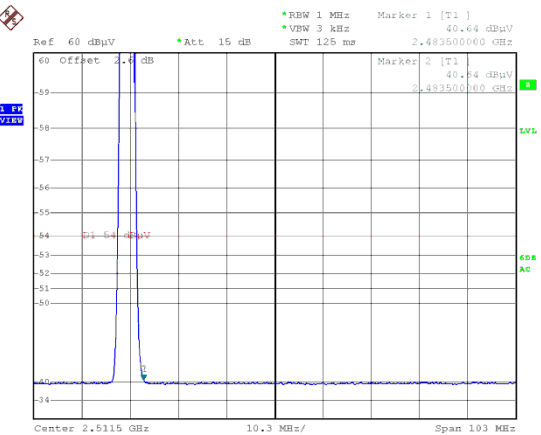
Date: 18.APR.2016 23:17:43

Vertical
Peak



Date: 18.APR.2016 23:21:19

Average



Date: 18.APR.2016 23:22:21

10. Transmitter Power Spectral Density

10.1 Measurement procedure

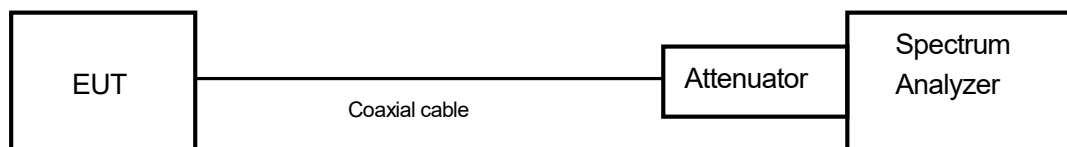
[FCC 15.247(e), RSS-247 5.2(2), KDB558074 D01 v03r05, Section 10.2]

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 = at least 1.5 times the 6 dB bandwidth.
- b) RBW = 3kHz - 100kHz.
- c) VBW $\geq 3 \times$ RBW.
- d) Sweep time = auto-couple.
- e) Detector = peak.
- f) Trace mode = max hold.

- Test configuration



10.2 Limit

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

10.3 Measurement result

Date : April 19, 2016

Temperature : 23.8 [°C]

Humidity : 30.2 [%]

Test place : Shielded room No.4

Test engineer :

Taiki Watanabe

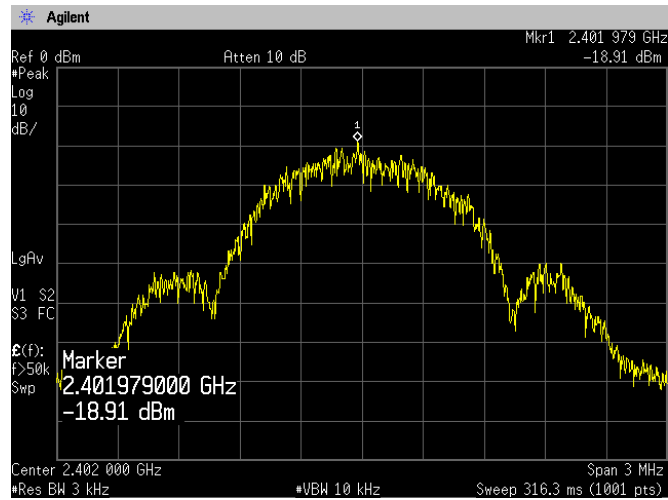
Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dBm)	Result
Low	2412.00	-18.91	10.52	-8.39	8.00	16.39	PASS
Middle	2440.00	-18.89	10.52	-8.37	8.00	16.37	PASS
High	2480.00	-19.88	10.52	-9.36	8.00	17.36	PASS

Calculation;

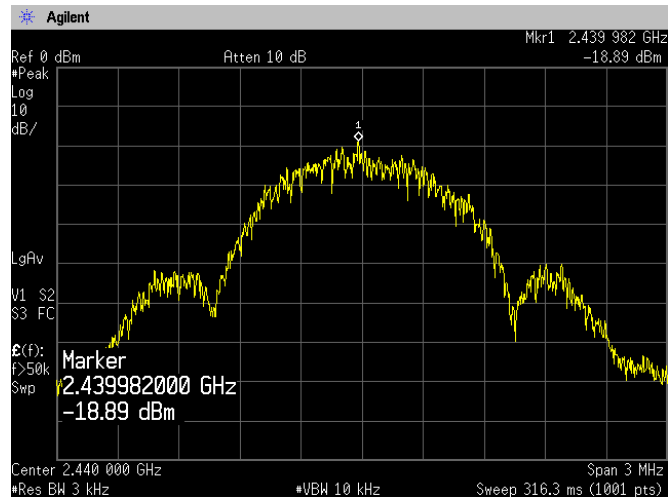
Transmitter Power Spectral Density Level (Margin) = Limit – (Reading + Factor)

10.4 Trace data

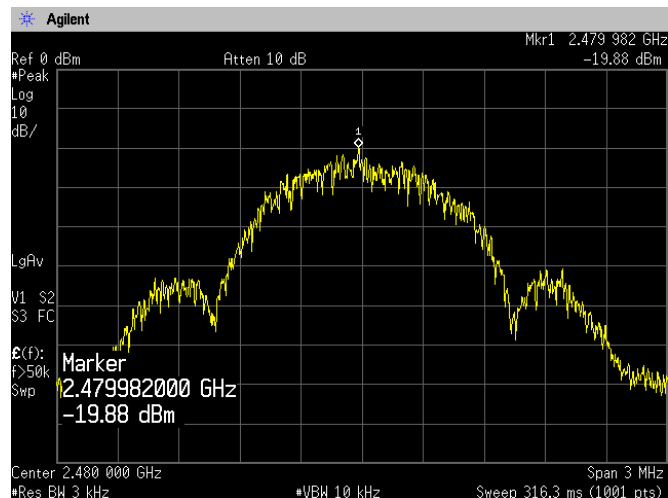
Channel Low



Channel Middle



Channel High



11. AC Power Line Conducted Emissions

11.1 Measurement procedure [FCC 15.207, RSS-Gen 8.8]

Test was applied by following conditions.

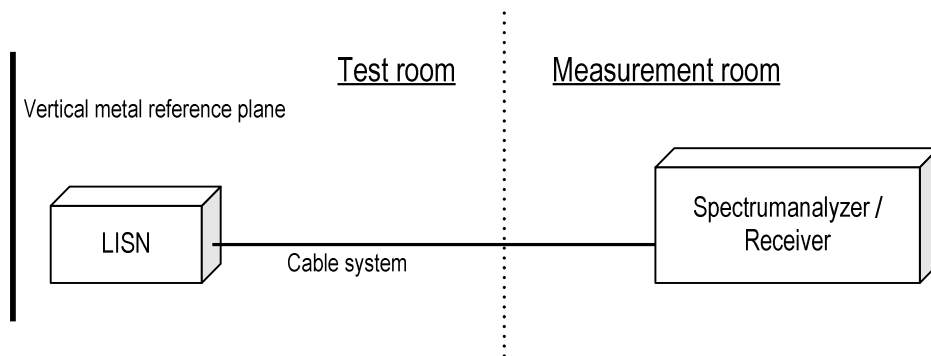
Test method	: ANSI C63.10
Frequency range	: 0.15MHz to 30MHz
Test place	: 3m Semi-anechoic chamber
EUT was placed on	: FRP table / (W)2.0m × (D)1.0m × (H)0.8m
Vertical Metal Reference Plane	: (W)2.0m × (H)2.0m 0.4m away from EUT
Test receiver setting	
- Detector	: Quasi-peak, Average
- Bandwidth	: 9kHz

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



11.2 Calculation method

Emission level = Reading + (LISN. factor + Cable system loss)

Margin = Limit – Emission level

Example:

Limit @ 6.770MHz : 60.0dBμV(Quasi-peak)
: 50.0dBμV(Average)

(Quasi peak) Reading = 41.2dBμV c.f = 10.3dB
Emission level = 41.2 + 10.3 = 51.5dBμV
Margin = 60.0 – 51.5 = 8.5dB

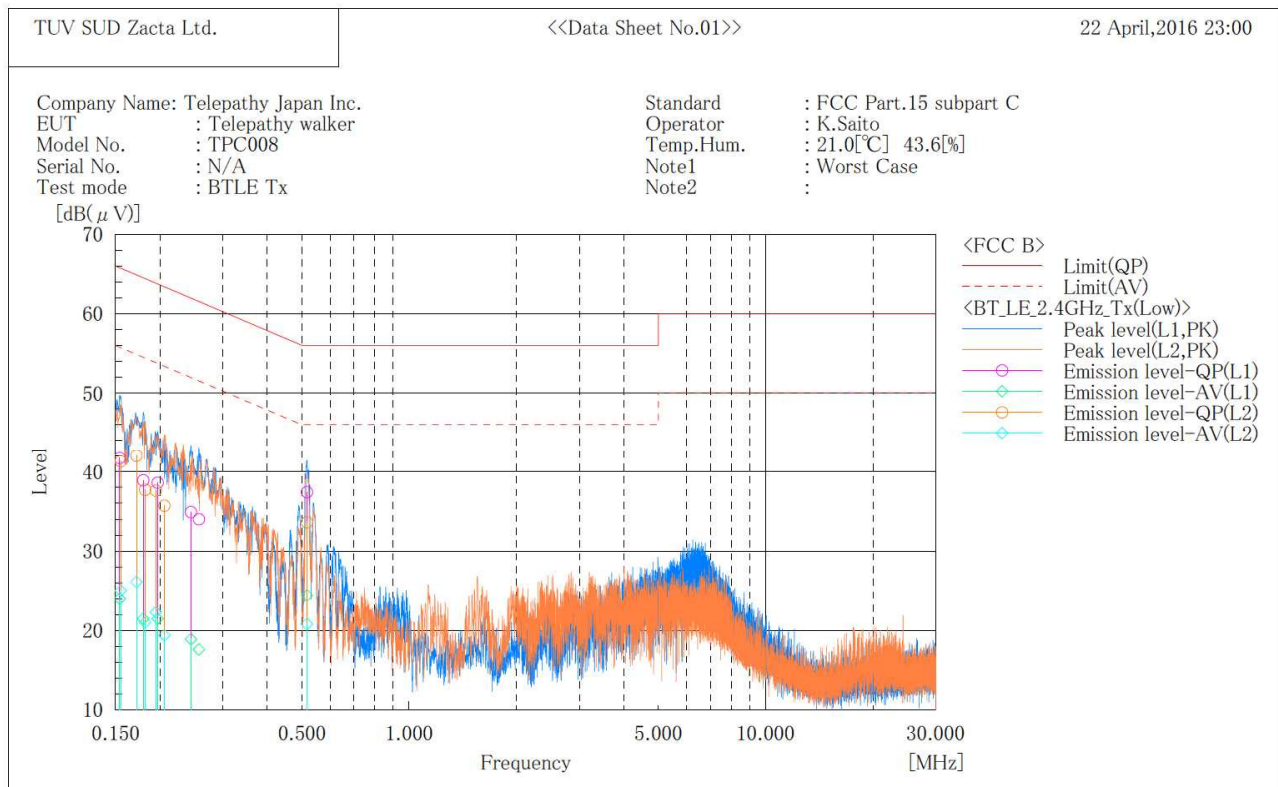
(Average) Reading = 35.0dBμV c.f = 10.3dB
Emission level = 35.0 + 10.3 = 45.3dBμV
Margin = 50.0 – 45.3 = 4.7dB

11.3 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.

11.4 Test data



Final Result

--- L1 Phase ---

No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading AV [dB(μV)]	c. f [dB]	Result QP [dB(μV)]	Result AV [dB(μV)]	Limit QP [dB(μV)]	Limit AV [dB(μV)]	Margin QP [dB]	Margin AV [dB]	Remark
1	0.15415	31.2	13.5	10.5	41.7	24.0	65.8	55.8	24.1	31.8	
2	0.17965	28.4	11.0	10.5	38.9	21.5	64.5	54.5	25.6	33.0	
3	0.19715	28.2	11.1	10.4	38.6	21.5	63.7	53.7	25.1	32.2	
4	0.24425	24.5	8.5	10.4	34.9	18.9	62.0	52.0	27.1	33.1	
5	0.2572	23.6	7.2	10.4	34.0	17.6	61.5	51.5	27.5	33.9	
6	0.51692	27.0	14.0	10.4	37.4	24.4	56.0	46.0	18.6	21.6	

--- L2 Phase ---

No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading AV [dB(μV)]	c. f [dB]	Result QP [dB(μV)]	Result AV [dB(μV)]	Limit QP [dB(μV)]	Limit AV [dB(μV)]	Margin QP [dB]	Margin AV [dB]	Remark
1	0.1553	30.7	14.4	10.6	41.3	25.0	65.7	55.7	24.4	30.7	
2	0.17187	31.4	15.5	10.6	42.0	26.1	64.9	54.9	22.9	28.8	
3	0.18182	27.1	10.4	10.6	37.7	21.0	64.4	54.4	26.7	33.4	
4	0.19476	27.1	11.8	10.5	37.6	22.3	63.8	53.8	26.2	31.5	
5	0.20572	25.2	8.9	10.5	35.7	19.4	63.4	53.4	27.7	34.0	
6	0.51648	23.2	10.4	10.4	33.6	20.8	56.0	46.0	22.4	25.2	

12. Antenna requirement

According to FCC section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that 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.

13. Uncertainty of measurement

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 100 028-0011 determining compliance or non-compliance with test result

Test item	Measurement uncertainty
Conducted emission at mains port	$\pm 3.0\text{dB}$
Radiated emission (9kHz – 30MHz)	$\pm 4.4\text{dB}$
Radiated emission (30MHz – 1000MHz)	$\pm 4.5\text{dB}$
Radiated emission (1000MHz – 26GHz)	$\pm 3.9\text{dB}$

14. Laboratory description

1. Location:

TÜV SÜD Zacta Ltd. Yonezawa Testing Center
 4149-7 Hachimanpara 5-chome Yonezawa-shi Yamagata 992-1128 Japan
 Phone: +81-238-28-2880 Fax: +81-238-28-2888

2. Facility filing information:

1) NVLAP accreditation: NVLAP Lab. code: 200306-0

2) VLAC accreditation: Lab. code: VLAC-013

Site name	Radiated emission	Conducted emission for mains port	Conducted emission for telecom port	Radiated emission (CMAD)	Expiry Date
3m Semi-anechoic chamber	VLAC-013	VLAC-013	VLAC-013	-	Jul. 3, 2017
10m Semi-anechoic chamber No.1				VLAC-013	
10m Semi-anechoic chamber No.2				VLAC-013	
Shielded room No.1	-	VLAC-013	-	-	

3) FCC filing:

Site name	Registration Number	Expiry Date
Site 3	91065	Oct. 1, 2017
3m Semi-anechoic chamber	540072	Feb. 20, 2017
10m Semi-anechoic chamber No.1		
10m Semi-anechoic chamber No.2		
Shielded room No.1		

4) Industry Canada Oats site filing:

Site name	Sites on file: Oats 3m/10m	Expiry Date
Site 3	4224A-3	Dec. 3, 2017
3m Semi-anechoic chamber	4224A-4	
10m Semi-anechoic chamber No.1	4224A-5	
10m Semi-anechoic chamber No.2	4224A-6	Jan. 15, 2017

5) VCCI site filing:

Site name	Radiated emission	Conducted emission for mains port	Conducted emission for telecom port	Expiry Date
Site 3	R-138	C-134	T-1222	Nov. 16, 2017
3m Semi-anechoic chamber	A-0166	A-0166	A-0166	Jul. 3, 2017
10m Semi-anechoic chamber No.1				
10m Semi-anechoic chamber No.2				
Shielded room No.1	-	A-0166		

6) TÜV SÜD PS authorization:

Authorized as an EMC test laboratory

7) TÜV Rheinland authorization:

Authorized as an EMC test laboratory

Appendix A. Test equipment

Antenna port conducted test

Equipment	Company	Model No.	Serial No.	Cal. due	Cal. date
Spectrum analyzer	Agilent Technologies	E4440A	US44302655	Jun. 30, 2016	Jun. 11, 2015
Microwave cable	RS	YH_13S5	N/A (S441)	May 31, 2016	May 12, 2015
Attenuator	Weinschel	56-10	J4993	Nov. 30, 2016	Nov. 12, 2015
Power meter	ROHDE&SCHWARZ	NRP2	103269	Jun. 30, 2016	Jun. 25, 2015
Power sensor	ROHDE&SCHWARZ	NRP-Z81	102467	Jun. 30, 2016	Jun. 25, 2015

Radiated emission

Equipment	Company	Model No.	Serial No.	Cal. Due	Cal. Date
EMI Receiver	ROHDE&SCHWARZ	ESCI	100764	Aug. 31, 2016	Aug. 21, 2015
Preamplifier	ANRITSU	MH648A	M96057	Jun. 30, 2016	Jun. 30, 2015
Loop antenna	ROHDE&SCHWARZ	HFH2-Z2	892246/010	Apr. 30, 2016	Apr. 2, 2015
Attenuator	TDC	TAT-43B-06	N/A (S209)	Apr. 30, 2016	Apr. 16, 2015
Biconical antenna	Schwarzbeck	VHA9103/BBA9106	2155	Jun. 30, 2016	Jun. 4, 2015
Log periodic antenna	Schwarzbeck	UHALP9108A	0560	Jun. 30, 2016	Jun. 4, 2015
Attenuator	TME	CFA-01NPJ-6	N/A (S275)	Jun. 30, 2016	Jun. 23, 2015
Attenuator	TME	CFA-01NPJ-3	N/A (S272)	Jun. 30, 2016	Jun. 23, 2015
Spectrum analyzer	Agilent Technologies	E4440A	US40420937	Jul. 31, 2016	Jul. 16, 2015
Preamplifier	ANRITSU	MH648A	M96057	Jun 30, 2016	Jun. 30, 2015
Double ridged guide antenna	EMCO	3115	5205	Mar. 31, 2017	Mar. 3, 2016
Attenuator	Agilent Technologies	8491B	MY39268633	Feb. 28, 2017	Feb. 23, 2016
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	BBHA9170189	Jun. 30, 2016	Jun. 16, 2015
Preamplifier	TSJ	MLA-100M18-B02-40	1929118	May 31, 2016	May 1, 2015
Attenuator	AEROFLEX	26A-10	081217-08	May 31, 2016	May 7, 2015
Notch filter	Micro-Tronics	BRM50702	045	Nov. 30, 2016	Nov. 12, 2015
Microwave cable	SUHNER	SUCOFLEX104/9m	MY30037/4	Oct. 31, 2016	Oct. 23, 2015
		SUCOFLEX104/1m	MY24610/4	Oct. 31, 2016	Oct. 23, 2015
		SUCOFLEX104/8m	MY30031/4	May 31, 2016	May 29, 2015
		SUCOFLEX104/1.5m	322086/4	May 31, 2016	May 29, 2015
PC	DELL	DIMENSION E521	75465BX	N/A	N/A
Software	TOYO Corporation	EP5/RE-AJ	0611193/V5.4.011	N/A	N/A
Absorber	RIKEN	PFP30	N/A	N/A	N/A
3m Semi-anechoic chamber	TOKIN	N/A	N/A (9002-NSA)	Apr. 30, 2016	Apr. 27, 2015
3m Semi-anechoic chamber	TOKIN	N/A	N/A (9002-SVSWR)	Apr. 30, 2016	Apr. 27, 2015

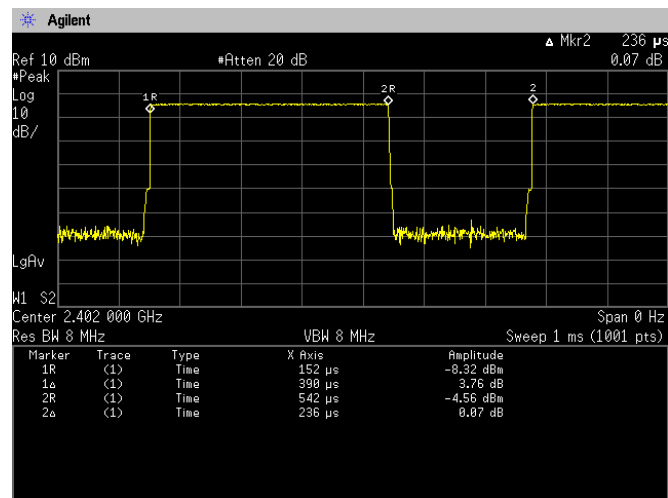
Conducted emission at mains port

Equipment	Company	Model No.	Serial No.	Cal. due	Cal. date
EMI Receiver	ROHDE&SCHWARZ	ESCI	100764	Aug. 31, 2016	Aug. 21, 2015
Attenuator	HUBER+SUHNER	6810.01.A	N/A (S411)	Feb. 28, 2017	Feb. 23, 2016
Line impedance stabilization network for EUT	Kyoritsu Electrical Works, Ltd.	KNW-407F	8-2003-1	Mar. 31, 2017	Mar. 28, 2016
Coaxial cable	FUJIKURA	5D-2W/4m	N/A (S330)	Feb. 28, 2017	Feb. 23, 2016
Coaxial cable	FUJIKURA	5D-2W/1m	N/A (S193)	Feb. 28, 2017	Feb. 23, 2016
Coaxial cable	SUHNER	RG214/U/10m	N/A (S194)	Feb. 28, 2017	Feb. 23, 2016
PC	DELL	DIMENSION	75465BX	N/A	N/A
Software	TOYO Corporation	EP5/CE-AJ	0611193/V5.6.000	N/A	N/A

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

Appendix B. Duty Cycle

[Plot & Calculation]



$$\text{Duty Cycle} = T_{\text{on}} / (T_{\text{on}} + T_{\text{off}}) = 390[\mu\text{s}] / (390[\mu\text{s}] + 236[\mu\text{s}]) = 62.3[\%]$$