TEST REPORT

KCTL Inc.
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1. Applicant

Name:	SAM JIN CO., LTD.
Address:	(Anyang-dong) 81, Anyangcheonseo-ro, Manan-gu Anyang-si, Gyeonggi-do, Korea

2. Sample Description:

FCC ID:	2AF4S-STH-ETH-250
IC ID:	20753-STHETH250
Type of equipment:	Hub
Basic Model:	STH-ETH-250

3. Date of Test: July 1 ~ July 4, 2016

4. Test method used: FCC Part 15 Subpart C, 15.247
RSS-247 Issue 1 May 2015
RSS GEN Issue 4 November 2014

5. Test Results

Test Item:	Refer to page 7
Result:	Complied (Refer to page 8 ~ page 18)
Measurement Uncertainty:	Refer to page 7

This result shown in this report refer only to the sample(s) tested unless otherwise stated.

Affirmation	Tested by Name: TAEK YONG, NAM	Technical Manager Name: MIN GI, SON

2016. 07. 12

KCTL Inc.

[Contents]

1. Client information

Applicant:	SAM JIN CO., LTD.
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Telephone number:	+82-31-467-5949
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Contact person:	Jung Woo Kim / jungwoo@samjin.com

Manufacturer:	SAM JIN CO., LTD.
Address:	(Anyang-dong) 81, Anyangcheonseo-ro, Manan-gu Anyang-si, Gyeonggi-do, Korea

2. Laboratory information

Address

KCTL Inc.
65 Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea
Telephone Number: 82-70-5008-1016 Facsimile Number: 82-505-299-8311

Certificate

KOLAS No.: KT231
FCC Site Designation No.: KR0040
FCC Site Registration No.: 687132
VCCI Site Registration No.: R-3327, G-198, C-3706, T-1849
IC Site Registration No.:8035A-2

SITE MAP

3. Description of E.U.T.

3.1 Basic description

Applicant:	SAM JIN CO., LTD.
Address of Applicant	(Anyang-dong) 81, Anyangcheonseo-ro, Manan-gu Anyang-si, Gyeonggi-do, Korea
Manufacturer	SAM JIN CO., LTD.
Address of Manufacturer	(Anyang-dong) 81, Anyangcheonseo-ro, Manan-gu Anyang-si, Gyeonggi-do, Korea
Type of equipment	Hub
Basic Model	STH-ETH-250
Serial number	N/A

3.2 General description

Frequency Range	2 402 ㎒ ~ 2 480 ㎒ (Bluetooth Low Energy), 2 405 ㎒ ~ 2 470 ㎒ (Zigbee), 908.42 ㎒, 908.4 ㎒, 916 ㎒ (Z-Wave)
Type of Modulation	GFSK (Bluetooth Low Energy), O-QPSK (Zigbee), 2FSK (908.42 ㎒, 908.4 ㎒), 2GFSK (916 ㎒)
Number of Channels	40 ch (Bluetooth Low Energy), 14 ch (Zigbee), 3 ch (Z-Wave)
Type of Antenna	PCB Antenna (Bluetooth Low Energy, Zigbee), Helical Antenna (Z-Wave)
Antenna Gain	3.29 ㏈i (Bluetooth Low Energy), 3.53 ㏈i (Zigbee)
Transmit Power	18.28 ㏈m
Power supply	DC 5.0 Ⅴ
Product SW/HW version	1.0
Radio SW/HW version	1.0
Test SW Version	Tera Term version 4.88
RF power setting in TEST SW	-6
Certified module	Z-wave module. Model Name: ZM5304-U, FCC ID: D87-ZM5304-U, IC ID: 11263A-ZM5304-U

Note : The above EUT information was declared by the manufacturer.

3.3 Test frequency

	Frequency
Lowest frequency	2 405 ㎒
Middle frequency	2 440 ㎒
Highest frequency	2 470 ㎒

3.4 Test Voltage

Mode	Voltage
Nominal Voltage	DC 5.0 Ⅴ

4. Summary of test results

4.1 Standards & results

FCC Rule Reference	IC Rule Reference	Parameter	Report Section	Test Result
15.203, 15.247(b)(4)	-	Antenna Requirement	5.1	C
15.247(b)(3)	RSS-247, 5.4(4)	Maximum Peak Output Power	5.2	NT1)
15.247(e)	RSS-247, 5.2(2)	Peak Power Spectral Density	5.3	NT1)
15.247(a)(2)	RSS-247, 5.2(1)	6 dB Channel Bandwidth	5.4	NT1)
-	RSS-GEN, 6.6	Occupied Bandwidth	5.4	NT1)
15.247(d), 15.205(a), 15.209(a)	RSS-247, 5.5 RSS-GEN, 8.9, 10	Spurious Emission, Band Edge, and Restricted bands	5.5	C
15.207(a)	RSS-GEN, 8.8	Conducted Emissions	5.6	C

Note: C = complies, NC = Not complies, NT = Not tested, NA = Not Applicable
NT1) : Since this is C2PC evaluation due to PCB art-work, only spurious emission and AC line test has done. Please refer to original test report # KCTL16-SFR0010.

Note: The general test methods used to test this device is ANSI C63.10:2013

4.2 Uncertainty

Measurement Item	Expanded Uncertainty U = *k*Uc (*k* = 2)	
Conducted RF power	1.44 dB	
Conducted Spurious Emissions	1.52 dB	
Radiated Spurious Emissions	30 MHz ~ 300 MHz:	+ 4.94 dB, - 5.06 dB
		+ 4.93 dB, - 5.05 dB
	300 MHz ~ 1 000 MHz:	+ 4.97 dB, - 5.08 dB
		+ 4.84 dB, - 4.96 dB
	1 GHz ~ 25 GHz:	+ 6.03 dB, - 6.05 dB
Conducted Emissions	9 kHz ~ 150 kHz:	3.75 dB
	150 kHz ~ 30 MHz:	3.36 dB

5. Test results

5.1 Antenna Requirement

5.1.1 Regulation

According to §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 use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBI. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.1.2 Result

- Complied

The transmitter has a PCB Antenna. The transmitter has a Internal Antenna which is attached on PCB permanently.

5.5 Spurious Emission, Band Edge, and Restricted bands

5.5.1 Regulation

According to §15.247(d), in any 100 ㎑ bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 ㏈ below that in the 100 ㎑ bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 ㏈ instead of 20 ㏈. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

According to §15.209(a), Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall notexceed the field strength levels specified in the following table:

Frequency (㎒)	Field strength (㎶/m)	Measurement distance (m)
0.009 - 0.490	2 400/F(㎑)	300
0.490 - 1.705	24 000/F(㎑)	30
1.705 - 30	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54–72 ㎒, 76–88 ㎒, 174–216 ㎒ or 470–806 ㎒. However, operation within these frequency bands is permItted under other sections of this part, e.g., §§15.231 and 15.241.

According to § 15.205(a) and (b), only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.009 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505	16.694 75 - 16.695 25	608 - 614	5.35 - 5.46
2.173 5 - 2.190 5	16.804 25 - 16.804 75	960 – 1 240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1 300 – 1 427	8.025 - 8.5
4.177 25 - 4.177 75	37.5 - 38.25	1 435 – 1 626.5	9.0 - 9.2
4.207 25 - 4.207 75	73 - 74.6	1 645.5 – 1 646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1 660 – 1 710	10.6 - 12.7
6.267 75 - 6.268 25	108 - 121.94	1 718.8 – 1 722.2	13.25 - 13.4
6.311 75 - 6.312 25	123 - 138	2 200 – 2 300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2 310 – 2 390	15.35 - 16.2
8.362 - 8.366	156.524 75 - 156.525 25	2 483.5 – 2 500	17.7 - 21.4
8.376 25 - 8.386 75	156.7 - 156.9	2 690 – 2 900	22.01 - 23.12
8.414 25 - 8.414 75	162.012 5 - 167.17	3 260 – 3 267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3 332 – 3 339	31.2 - 31.8
12.519 75 - 12.520 25	240 - 285	3 345.8 – 3 358	36.43 - 36.5
12.576 75 - 12.577 25	322 - 335.4	3 600 – 4 400	Above 38.6
13.36 - 13.41			

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1 000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1 000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

5.5.2Measurement Procedure

5.5.2.1 Band-edge Compliance of RF Conducted Emissions

5.5.2.1.1 Reference Level Measurement

Establish a reference level by using the following procedure:

1) Set instrument center frequency to DTS channel center frequency.
2) Set the span to ≥ 1.5 times the DTS bandwidth.
3) Set the RBW = 100 ㎑.
4) Set the VBW ≥ 3 x RBW.
5) Detector = peak.
6) Sweep time = auto couple.
7) Trace mode = max hold.
8) Allow trace to fully stabilize.
9) Use the peak marker function to determine the maximum PSD level.

5.5.2.1.2 Emissions Level Measurement

1) Set the center frequency and span to encompass frequency range to be measured.
2) Set the RBW = 100 ㎑.
3) Set the VBW ≥ 3 x RBW.
4) Detector = peak.
5) Ensure that the number of measurement points ≥ span/RBW
6) Sweep time = auto couple.
7) Trace mode = max hold.
8) Allow trace to fully stabilize.
9) Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in 11.1 a) or 11.1 b). Report the three highest emissions relative to the limit.

5.5.2.2 Conducted Spurious Emissions

Set the spectrum analyzer as follows:

1) Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
2) RBW = 100 ㎑
3) VBW ≥ RBW
4) Sweep = auto
5) Detector function = peak
6) Trace = max hold
7) Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
8) Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.

5.5.2.3 Radiated Spurious Emissions

1) The preliminary and final rdiated measurements were performed to determine the frequency producing the maximum emissions in at a 10m anechoic chamber. The EUT was tested at a distance 3 meters.
2) The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360°.
3) The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 9 ㎑ to 30 ㎒ using the loop antenna, and from 30 to 1 000 ㎒ using the TRILOG broadband antenna, and from 1 000 ㎒ to 26 500 ㎒ using the horn antenna.
4) Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.

Note

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 ㎑ for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1 ㎓.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 ㎒ for Peak detection and frequency above 1 ㎓.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 ㎒ and the video bandwidth is 1 ㎑(≥1/T) for Average detection (AV) at frequency above 1 ㎓. **(**where T = pulse width)

5.5.3 Test Result

- Complied

1. Conducted Spurious Emissions was shown in figure 3.
   Note: We took the insertion loss of the cable into consideration within the measuring instrument.
2. Measured value of the Field strength of spurious Emissions (Radiated)
3. It tested x,y and z – 3 axis each, mentioned only worst case data at this report.

- Below 1 ㎓ data (worst-case)

Highest channel (2 470 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 30 ㎒							
Below 30.00	**Not Detected**	-	-	-	-	-	-
Quasi-Peak DATA. Emissions below 1 ㎓							
46.85	120	V	46.90	-11.50	35.40	40.00	4.60
82.14	120	V	51.90	-15.70	36.20	40.00	3.80
89.41	120	V	55.90	-16.40	39.50	43.50	4.00
Above 90.00	**Not Detected**	-	-	-	-	-	-

- Above 1 ㎓ data

Lowest channel (2 405 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓							
2 389.50[1)]	1 000	H	50.80	3.50	54.30	74.00	19.70
4 239.38	1 000	H	33.90	7.90	41.80	74.00	32.20
4 809.38[2)]	1 000	H	41.30	9.50	50.80	74.00	23.20
6 646.88	1 000	H	31.60	13.00	44.60	74.00	29.40
8 229.38	1 000	H	32.10	15.40	47.50	74.00	26.50
9 583.12	1 000	H	31.30	16.30	47.60	74.00	26.40
10 775.62	1 000	H	31.50	19.30	50.80	74.00	23.20
Above 11 000.00	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 ㎓							
2 389.50[1)]	1 000	H	42.20	3.50	45.70	54.00	8.30
4 239.38	1 000	H	23.70	7.90	31.60	54.00	22.40
4 809.38[2)]	1 000	H	34.80	9.50	44.30	54.00	9.70
6 646.88	1 000	H	22.60	13.00	35.60	54.00	18.40
8 229.38	1 000	H	21.90	15.40	37.30	54.00	16.70
9 583.12	1 000	H	22.10	16.30	38.40	54.00	15.60
10 775.62	1 000	H	22.50	19.30	41.80	54.00	12.20
Above 11 000.00	Not Detected	-	-	-	-	-	-

[1)] Restricted band.
[2)] Harmonic components.

Middle channel (2 440 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓							
3 941.25	1 000	H	33.60	6.60	40.20	74.00	33.80
4 880.63	1 000	H	42.80	9.10	51.90	74.00	22.10
6 095.63	1 000	H	32.10	12.30	44.40	74.00	29.60
7 321.88	1 000	V	39.20	14.40	53.60	74.00	20.40
8 045.63	1 000	H	31.70	15.10	46.80	74.00	27.20
9 444.37	1 000	H	32.10	16.10	48.20	74.00	25.80
Above 10 000.00	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 ㎓							
3 941.25	1 000	H	24.40	6.60	31.00	54.00	23.00
4 880.63	1 000	H	36.80	9.10	45.90	54.00	8.10
6 095.63	1 000	H	22.50	12.30	34.80	54.00	19.20
7 321.88	1 000	V	30.80	14.40	45.20	54.00	8.80
8 045.63	1 000	H	22.20	15.10	37.30	54.00	16.70
9 444.37	1 000	H	22.20	16.10	38.30	54.00	15.70
Above 10 000.00	Not Detected	-	-	-	-	-	-

Highest channel (2 470 ㎒)

Frequency [㎒]	Receiver Bandwidth [㎑]	Pol. [V/H]	Reading [dB(㎶)]	Factor [dB]	Result [dB(㎶/m)]	Limit [dB(㎶/m)]	Margin [dB]
Peak DATA. Emissions above 1 ㎓							
2 483.50[1)]	1 000	H	52.60	3.60	56.20	74.00	17.80
3 963.75	1 000	H	33.50	6.60	40.10	74.00	33.90
4 940.63[2)]	1 000	H	45.10	9.20	54.30	74.00	19.70
6 485.63	1 000	H	32.30	12.70	45.00	74.00	29.00
7 411.88[2)]	1 000	H	37.90	14.50	52.40	74.00	21.60
8 962.50	1 000	H	32.00	16.80	48.80	74.00	25.20
10 959.37	1 000	H	32.20	19.80	52.00	74.00	22.00
Above 11 000.00	Not Detected	-	-	-	-	-	-
Average DATA. Emissions above 1 ㎓							
2 483.50[1)]	1 000	H	44.20	3.60	47.80	54.00	6.20
3 963.75	1 000	H	24.50	6.60	31.10	54.00	22.90
4 940.63[2)]	1 000	H	39.50	9.20	48.70	54.00	5.30
6 485.63	1 000	H	22.40	12.70	35.10	54.00	18.90
7 411.88[2)]	1 000	H	29.80	14.50	44.30	54.00	9.70
8 962.50	1 000	H	21.90	16.80	38.70	54.00	15.30
10 959.37	1 000	H	22.10	19.80	41.90	54.00	12.10
Above 11 000.00	Not Detected	-	-	-	-	-	-

[1)] Restricted band.
[2)] Harmonic components.

5.6 Conducted Emission

5.6.1 Regulation

According to §15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 ㎑ to 30 ㎒, shall not exceed the limits in the following table, as measured using a 50 μH/50 Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (㎒)	Conducted limit (㏈㎶)	
	Quasi-peak	Average
0.15 – 0.5	66 to 56 *	56 to 46 *
0.5 – 5	56	46
5 – 30	60	50

* Decreases with the logarithm of the frequency.

According to §15.107(a), for unintentional device, except for Class A digital devices, line conducted emission limits are the same as the above table.

5.6.2 Measurement Procedure

1) The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 ㎝ in which is located 40 ㎝ away from the vertical wall and 1.5m away from the side wall of the shielded room.

2) Each current-carrying conductor of the EUT power cord was individually connected through a 50Ω/50μH LISN, which is an input transducer to a Spectrum Analyzer or an EMI/Field Intensity Meter, to the input power source.

3) Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.

4) The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 ㎒ to 30 ㎒.

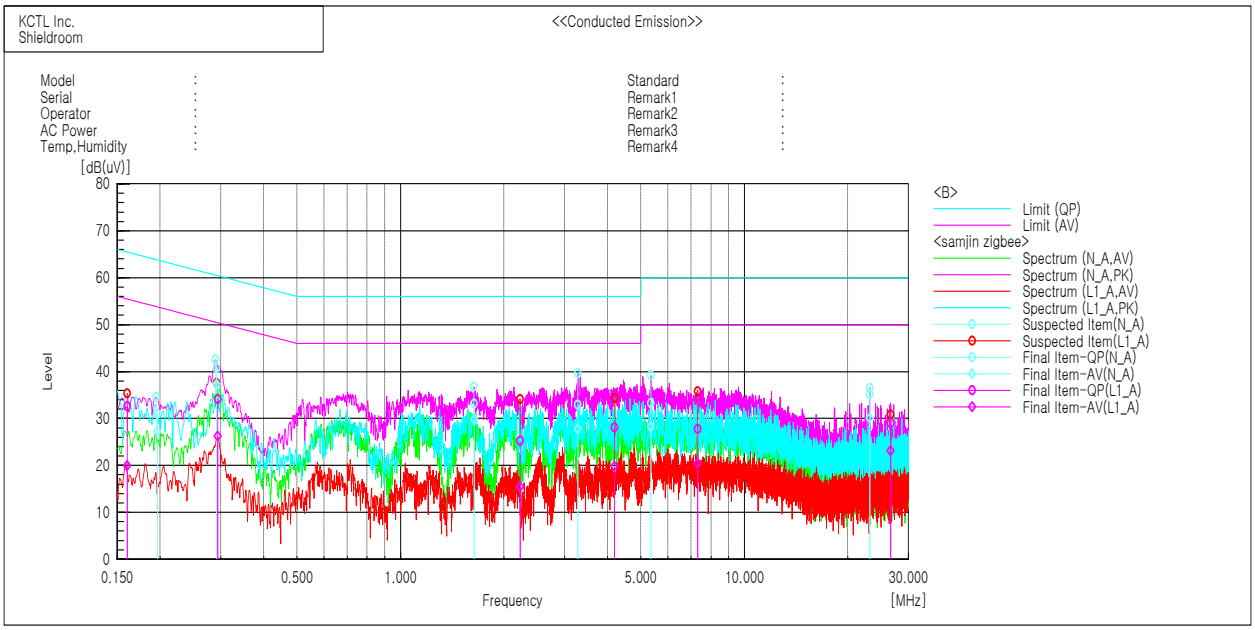
5) The measurements were made with the detector set to PEAK amplitude within a bandwidth of 10 ㎑ or to QUASI-PEAK and AVERAGE within a bandwidth of 9 ㎑. The EUT was in transmitting mode during the measurements.

5.6.3 Test Result

- Complied

Figure 4. plot of Conducted Emission

- Conducted worst-case data : Highest Channel (2 470 ㎒)



Final Result

--- N_A Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.19637	20.9	17.3	10.0	30.9	27.3	63.8	53.8	32.9	26.5
2	0.29194	30.8	27.4	9.9	40.7	37.3	60.5	50.5	19.8	13.2
3	1.63555	23.1	19.7	10.1	33.2	29.8	56.0	46.0	22.8	16.2
4	3.28176	22.5	17.3	10.4	32.9	27.7	56.0	46.0	23.1	18.3
5	5.34933	22.3	17.3	10.9	33.2	28.2	60.0	50.0	26.8	21.8
6	23.12941	19.3	14.1	16.0	35.3	30.1	60.0	50.0	24.7	19.9

--- L1_A Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.16029	22.7	10.1	9.9	32.6	20.0	65.4	55.4	32.8	35.4
2	0.29423	24.2	16.3	9.9	34.1	26.2	60.4	50.4	26.3	24.2
3	2.22584	14.6	4.8	10.6	25.2	15.4	56.0	46.0	30.8	30.6
4	4.19629	17.3	9.0	10.8	28.1	19.8	56.0	46.0	27.9	26.2
5	7.31548	16.7	9.4	11.1	27.8	20.5	60.0	50.0	32.2	29.5
6	26.61075	13.4	7.6	15.6	29.0	23.2	60.0	50.0	31.0	26.8

6. Test equipment used for test

	Description	Manufacturer	Model No.	Serial No.	Next Cal Date.
■	Test Receiver	R & S	ESR7	101078	17.02.26
■	Bi-Log Antenna	SCHWARZBECK	VULB 9168	583	16.06.19
■	Amplifier	SONOMA INSTRUMENT	310N	188280	17.04.07
■	ATTENUATOR	EM TEST	ATT6/80	P1402129094	17.04.08
■	Turn Table	MATURO	CO2000-SOFT	-	-
■	Antenna Mast	MATURO	AM4.0	079/3440509	-
■	Broadband Preamplifier	SCHWARZBECK	BBV9718	9718-233	17.01.09
■	LOOP Antenna	R & S	HFH2-Z2	100355	18.03.03
■	Horn antenna	ETS.lindgren	3116	86632	16.11.05
■	Horn antenna	ETS.lindgren	3117	00155787	16.11.25
■	Broadband Preamplifier	SCHWARZBECK	BBV9721	2	17.05.03
■	DC POWER SUPPLY	AGILENT	E3632A	KR73001026	17.01.07
■	SPECTRUM ANALYZER	R & S	FSV30	101437	16.11.03
■	VECTOR SIGNAL GENERATOR	R & S	SMBV100A	257566	17.01.07
■	SIGNAL GENERATOR	R & S	SMB100A	176206	17.03.14
■	WIDEBAND POWER SENSOR	R & S	NRP-Z81	102398	17.02.11
■	Highpass Filter	Wainwright Instruments GmbH	WHKX3.0/ 18G-12SS	44	17.02.01
■	ATTENUATOR	HP	8491A	18591	17.05.03