

FCC Test Report

Product Name	WC Subsystem Qi. 1.3 Gen.4 3-Coil
Model No.	240000-01-200; 240000-01-201
FCC ID	2AQWT24000001200

Applicant	acv GmbH
Address	Strassburger Allee 10-12, Erkelenz 41812 Germany

Date of Receipt	May 16, 2022
Issued Date	Aug. 19, 2022
Report No.	2250430R-RFUSOTHV03-A
Report Version	V1.0



The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standard through the calibration of the equipment and evaluated measurement uncertainty herein.

This report must not be used to claim product endorsement by TAF or any agency of the government.

The test report shall not be reproduced without the written approval of DEKRA Testing and Certification Co., Ltd.

Measurement uncertainties evaluated for each testing system and associated connections are given here to provide the system information for reference. Compliance determinations do not take into account measurement uncertainties for each testing system, but are based on the results of the compliance measurement.

Test Report

Issued Date: Aug. 19, 2022

Report No.: 2250430R-RFUSOTHV03-A



Product Name	WC Subsystem Qi. 1.3 Gen.4 3-Coil
Applicant	acv GmbH
Address	Strassburger Allee 10-12, Erkelenz 41812 Germany
Manufacturer	Santek Overseas Corp.
Model No.	240000-01-200; 240000-01-201
FCC ID.	2AQWT24000001200
EUT Rated Voltage	DC 12V by battery
EUT Test Voltage	DC 12V by battery
Trade Name	Inbay
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C ANSI C63.4: 2014, ANSI C63.10: 2013
Test Result	Complied

Documented By :



(Senior Project Specialist / Genie Chang)

Tested By :



(Senior Engineer / Bill Lin)

Approved By :



(Senior Engineer / Jack Hsu)

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Revision History

Report No.	Version	Description	Issued Date
2250430R-RFUSOTHV03-A	V1.0	Initial issue of report.	Aug. 19, 2022

1. GENERAL INFORMATION

1.1. EUT Description

Product Name	WC Subsystem Qi. 1.3 Gen.4 3-Coil
Trade Name	Inbay
Model No.	240000-01-200; 240000-01-201
FCC ID	2AQWT24000001200
Frequency Range	13.56MHz
Modulation	FSK
Antenna Type	Loop

Antenna List

No.	Manufacturer	Part No.	Antenna Type
1	Santek Overseas Corp.	LB91902-4TH-3	Loop

Frequency of Each Channel:

Channel	Frequency
---------	-----------

Channel 1:	13.56 MHz
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Note:

1. This device is a WC Subsystem Qi. 1.3 Gen.4 3-Coil with a built-in 13.56MHz transceiver.
2. The different of each model is shown as below:

Model Name	Description
240000-01-200	Subsystem With Can/NFC Function
240000-01-201	Subsystem With NFC Function

3. These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15 Subpart C Paragraph 15.225.
4. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report.

Test Mode	Mode 1: Transmit
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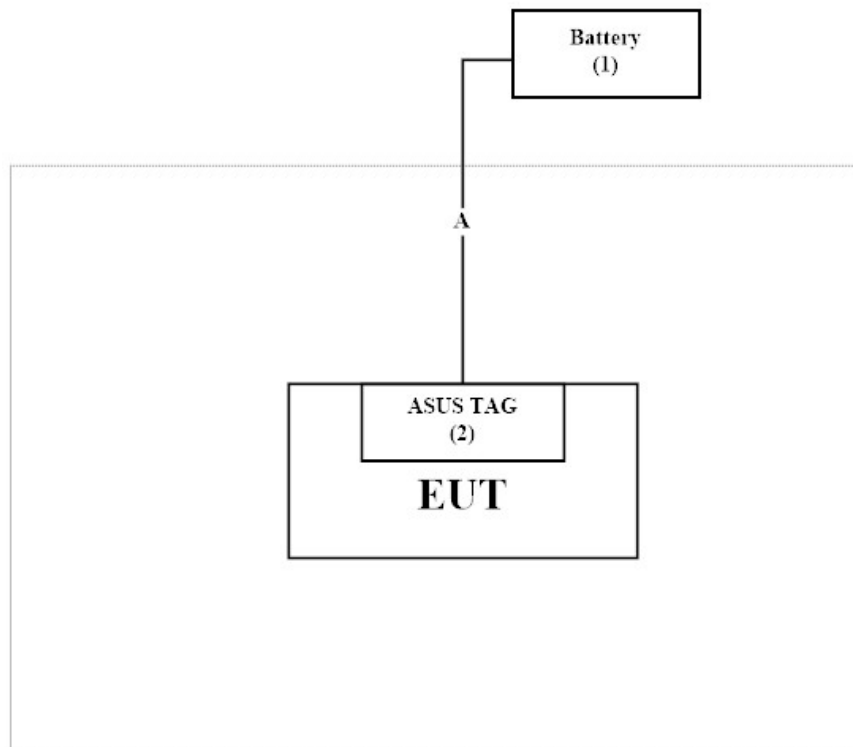
1.2. Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product	Manufacturer	Model No.	Serial No.	Power Cord
1 Battery	YUASA	55B24L-CMF II	N/A	N/A
2 ASUS TAG	ASUS	TAG	N/A	N/A

Signal Cable Type	Signal cable Description
A Power Cable	Shielded, 1.8m

1.3. Configuration of tested System



1.4. EUT Exercise Software

- (1) Setup the EUT as shown in Section 1.3.
- (2) Turn on the power of all equipment.
- (3) Start the continuous receiver.
- (4) Verify that the EUT works properly.

1.5. Test Facility

Ambient conditions in the laboratory:

Performed Item	Items	Required	Actual
Radiated Emission	Temperature (°C)	10~40 °C	23.5 °C
	Humidity (%RH)	10~90 %	55.1 %
Conductive	Temperature (°C)	10~40 °C	25°C
	Humidity (%RH)	10~90 %	50%

USA : FCC Registration Number: TW0023

Canada : IC Registration Number: 25880

Site Description : Accredited by TAF
Accredited Number: 3023

Test Laboratory : DEKRA Testing and Certification Co., Ltd
Address : No.159, Sec. 2, Wenhua 1st Rd., Linkou Dist.,
New Taipei City 24457, Taiwan, R.O.C.

Phone number : 886-2-2602-7968
Fax number : 886-2-2602-3286
Email address : info.tw@dekra.com
Website : <http://www.dekra.com.tw>

1.6. List of Test Equipment

For Conduction measurements / HY-SR01

	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due. Date
X	EMI Test Receiver	R&S	ESR7	101601	2022.06.23	2023.06.22
X	Two-Line V-Network	R&S	ENV216	101306	2022.05.23	2023.05.22
X	Two-Line V-Network	R&S	ENV216	101307	2022.07.04	2023.07.03
X	Coaxial Cable	SUHNER	RG400_BNC	RF001	2022.05.24	2023.05.23

Note:

1. All equipments are calibrated every one year.
2. The test instruments marked with "X" are used to measure the final test results.
3. Test Software version : E3 210616 dekra V9.

For Radiated measurements /HY-CB03

	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due. Date
X	Loop Antenna	AMETEK	HLA6121	49611	2022.03.18	2023.03.17
X	Bi-Log Antenna	SCHWARZBECK	VULB9168	9168-675	2021.08.11	2023.08.10
	Horn Antenna	ETS-Lindgren	3117	00201259	2021.11.09	2022.11.08
	Horn Antenna	Com-Power	AH-840	101087	2022.06.16	2023.06.15
X	Pre-Amplifier	SGH	SGH0301-9	20211007-10	2022.02.22	2023.02.21
	Pre-Amplifier	EMCI	EMC051835SE	980313	2021.11.24	2022.11.23
	Pre-Amplifier	EMCI	EMC05820SE	980310	2021.07.07	2022.07.06
	Pre-Amplifier	EMCI	EMC184045SE	980369	2022.05.12	2023.05.11
	Coaxial Cable	EMCI	EMC102-KM-KM-600	1160314		
	Coaxial Cable	EMCI	EMC102-KM-KM-7000	170242		
	Filter	MICRO TRONICS	BRM50702	G251	2021.09.16	2022.09.15
	Filter	MICRO TRONICS	BRM50716	G188	2021.09.16	2022.09.15
X	EMI Test Receiver	R&S	ESR	102793	2021.12.15	2022.12.14
X	Spectrum Analyzer	R&S	FSV3044	101113	2022.01.25	2023.02.24
X	Coaxial Cable	SGH	SGH18	2021005-1	2022.03.18	2023.03.17
	Coaxial Cable	SGH	SGH18	202108-4		
	Coaxial Cable	SGH	SGH18	GD20110223-1		
	Coaxial Cable	SGH	HA800	GD20110222-3		

Note:

1. Bi-Log Antenna is calibrated every two years, the other equipments are calibrated every one year.
2. The test instruments marked with "X" are used to measure the final test results.
3. Test Software version : E3 210616 dekra V9.

1.7. Uncertainty

Uncertainties have been calculated according to the DEKRA internal document, and is described in each test chapter of this report.

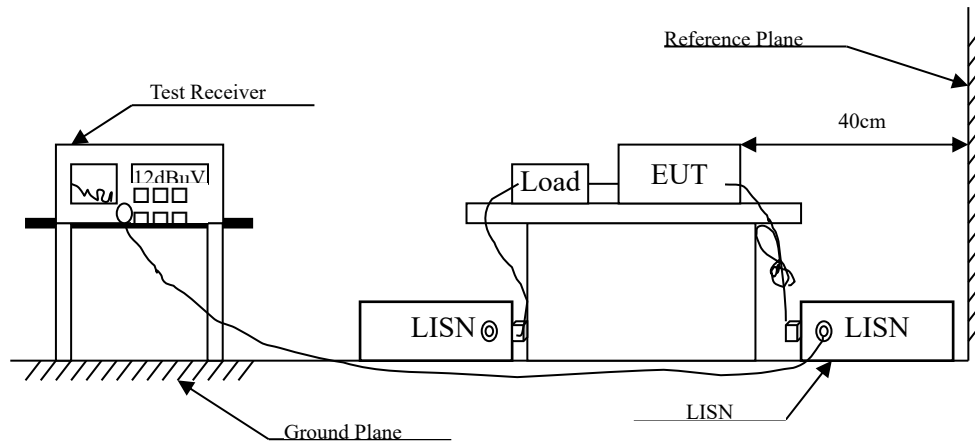
The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95%.

Measurement uncertainties evaluated for each testing system and associated connections are given here to provide the system information for reference. Compliance determinations do not take into account measurement uncertainties for each testing system, but are based on the results of the compliance measurement.

Test item	Uncertainty	
	Under 1GHz	Above 1GHz
Radiated Emission	±4.05 dB	±4.10 dB
Band Edge	Under 1GHz ±4.05 dB	Above 1GHz ±4.10 dB
Frequency Tolerance	±1544.74 Hz	

2. Conducted Emission

2.1. Test Setup



2.2. Limits

FCC Part 15 Subpart C Paragraph 15.207 (dBuV) Limit		
Frequency MHz	Limits	
	QP	AV
0.15 - 0.50	66-56 _(註)	56-46 _(註)
0.50-5.0	56	46
5.0 - 30	60	50

2.3. Test Procedure

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm /50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs.)

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4: 2014 on conducted measurement.

Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

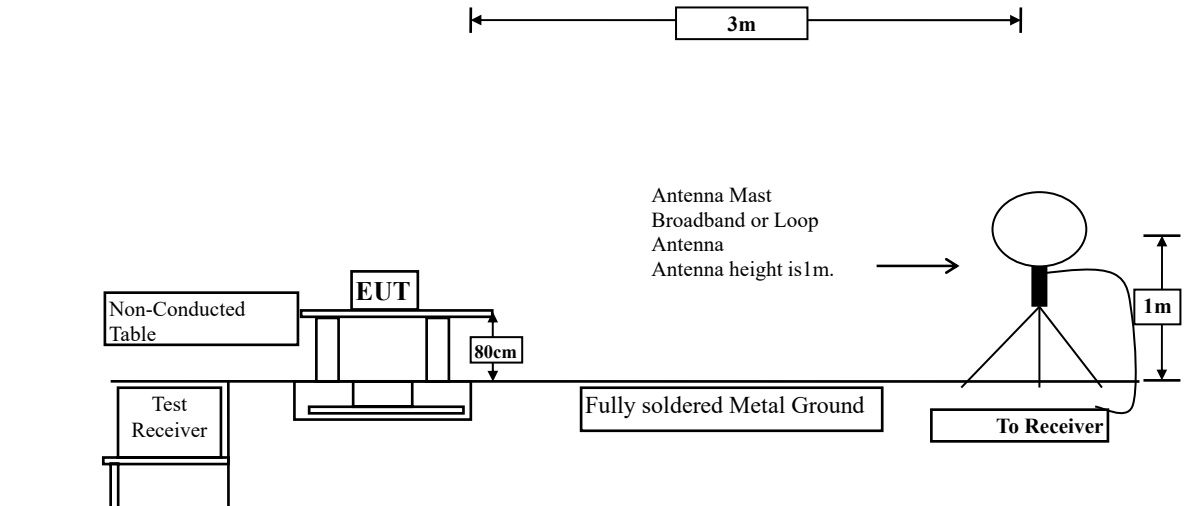
2.4. Test Result of Conducted Emission

Owing to the EUT use battery supply voltage, this test item is not performed.

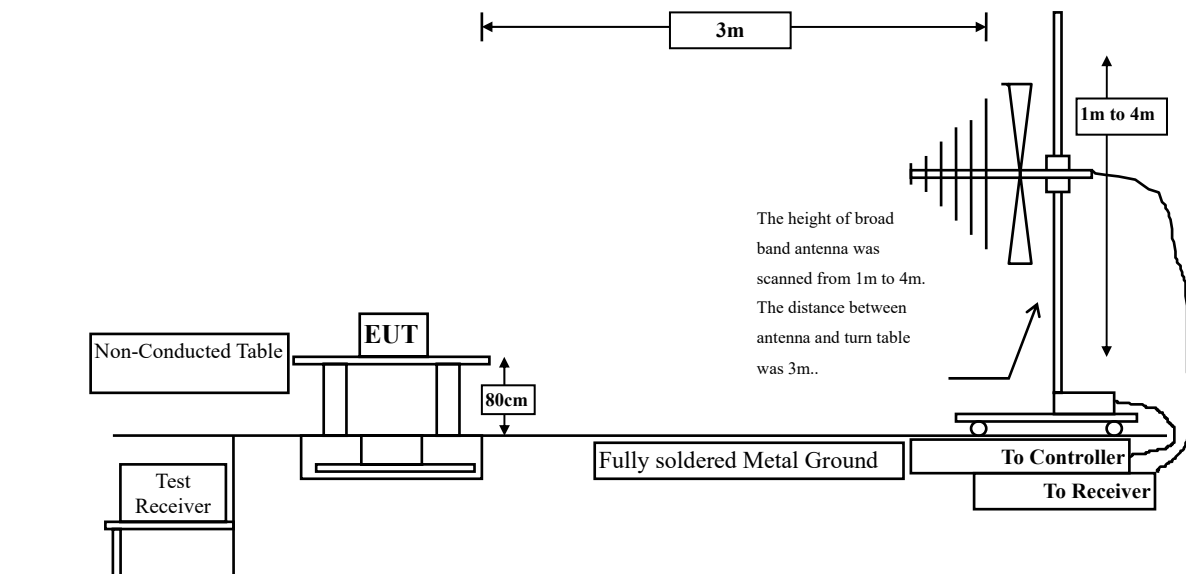
3. Radiated Emission

3.1. Test Setup

Radiated Emission Under 30MHz



Radiated Emission Below 1GHz



3.2. Limits

➤ Fundamental electric field strength Limit

FCC Part 15 Subpart C Paragraph 15.225 Limits				
Fundamental Frequency MHz	Field strength of fundamental			
	uV/m	Distance (meter)	dBuV/m	Distance (meter)
13.553 – 13.567	15848	30	124	3
13.410 – 13.553 and 13.567 – 13.710	334	30	90.47	3
13.110 – 13.410 and 13.710 – 14.010	106	30	80.50	3
Outside of the 13.110 – 14.010	See 15.209 Limits			

Remarks :

1. RF Voltage (dBuV) = 20 log RF Voltage (uV)
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
3. The emission limit in this paragraph is based on measurement instrumentation employing an quasi-peak detector.

➤ Spurious electric field strength Limit

FCC Part 15 Subpart C Paragraph 15.209 Limits		
Frequency MHz	Field strength (microvolts/meter)	Measurement distance (meter)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remarks :

1. RF Voltage (dBuV) = 20 log RF Voltage (uV)
2. In the Above Table, the tighter limit applies at the band edges.
3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

3.3. Test Procedure

Fundamental electric field strength:

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum electric field strength.

The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna which is 1 meter above ground. All X-axis, Y-axis and Z-axis polarization of the antenna are set on measurement.

Spurious electric field strength:

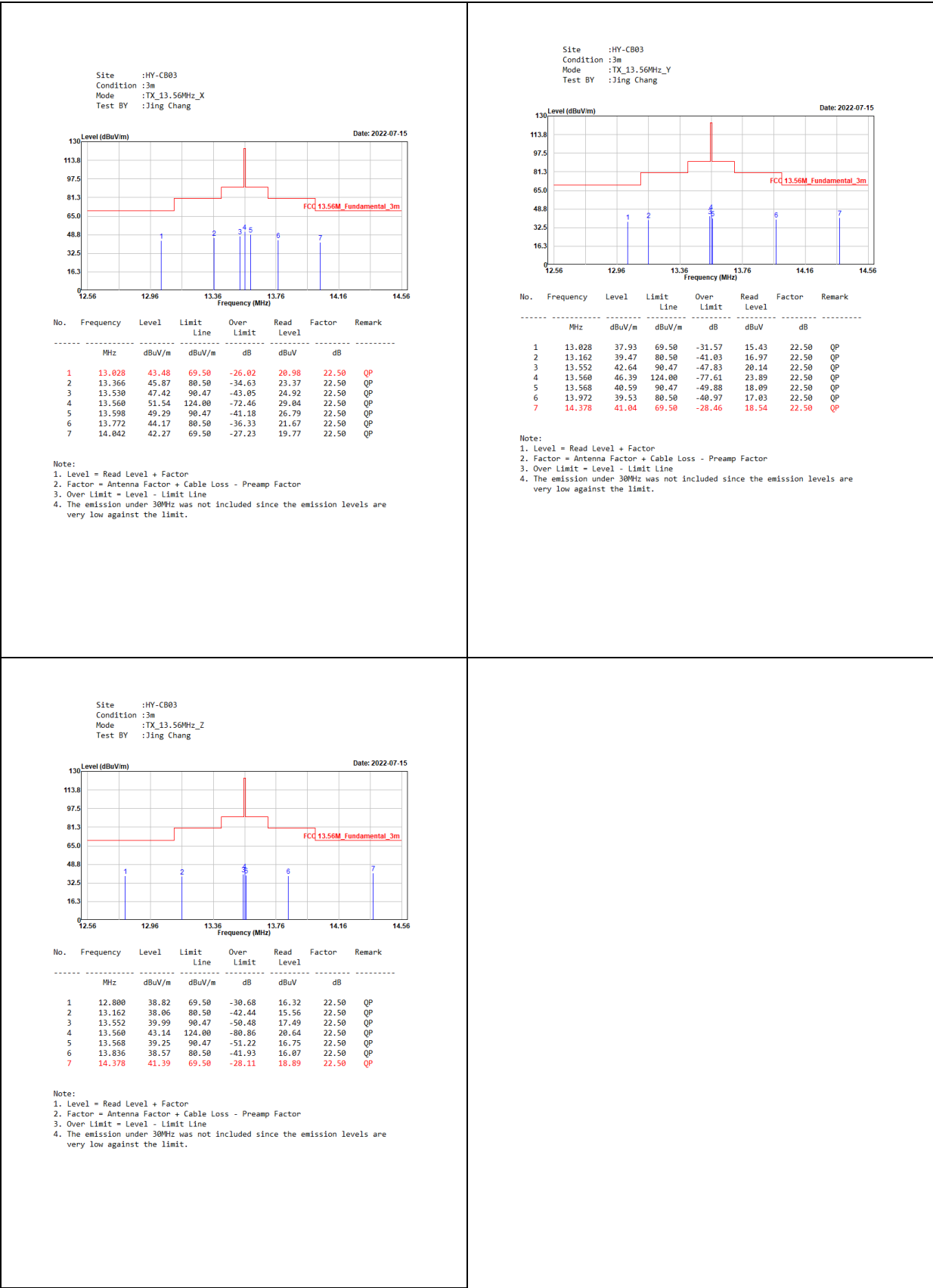
The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level.

The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

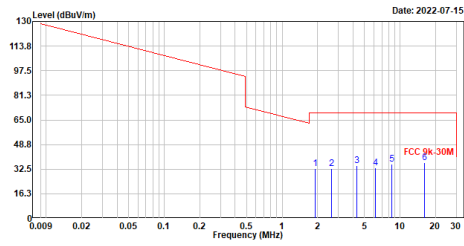
Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10: 2013 on radiated measurement.

The bandwidth below 30MHz setting on the field strength meter is 9kHz and above 30MHz is 120kHz. The frequency range from 9kHz to 10th harmonics is checked.

3.4. Test Result of Radiated Emission



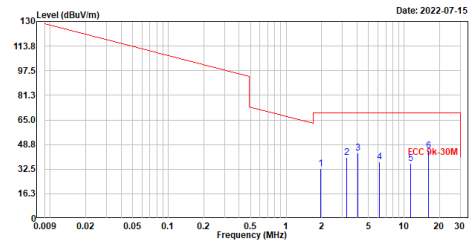
Site :HY-CB03
Condition :3m ,Horizontal
Mode :TX 9k-30M
Test BY :Jing Chang



No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	MHz	dBuV/m	Line	Limit	Level		
1	1.918	33.07	69.50	-36.43	13.25	19.82	QP
2	2.611	32.93	69.50	-36.57	13.31	19.62	QP
3	4.282	34.92	69.50	-34.58	15.04	19.88	QP
4	6.218	33.57	69.50	-35.93	12.89	20.68	QP
5	8.532	35.75	69.50	-33.75	13.95	21.80	QP
6	16.064	36.65	69.50	-32.85	14.15	22.50	QP

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Cable Loss - Preamp Factor
3. Over Limit = Level - Limit Line
4. The emission under 30MHz was not included since the emission levels are very low against the limit.

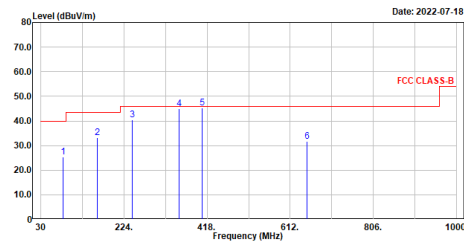
Site :HY-CB03
Condition :3m ,Vertical
Mode :TX 9k-30M
Test BY :Jing Chang



No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	MHz	dBuV/m	Line	Limit	Level		
1	1.965	32.84	69.50	-36.66	13.03	19.81	QP
2	3.250	40.05	69.50	-29.45	20.48	19.57	QP
3	4.045	43.20	69.50	-26.30	23.39	19.81	QP
4	6.218	37.41	69.50	-32.09	16.73	20.68	QP
5	11.334	36.28	69.50	-33.22	13.78	22.50	QP
6	16.064	44.63	69.50	-24.87	22.13	22.50	QP

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Cable Loss - Preamp Factor
3. Over Limit = Level - Limit Line
4. The emission under 30MHz was not included since the emission levels are very low against the limit.

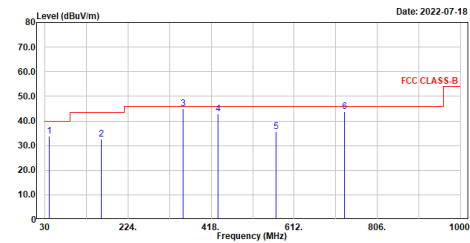
Site :HY-CB03
Condition :3m ,Horizontal
Mode :TX 30M-1G
Test BY :Ashton Chiu



No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	MHz	dBuV/m	Line	Limit	Level		
1	81.410	25.33	40.00	-14.67	55.53	-30.20	QP
2	161.920	33.31	43.50	-10.19	58.52	-25.21	QP
3	243.400	40.39	46.00	-5.61	67.15	-26.76	QP
4	352.040	45.01	46.00	-0.99	68.90	-23.89	QP
5	406.360	45.25	46.00	-0.75	67.80	-22.55	QP
6	650.800	31.60	46.00	-14.40	49.08	-17.48	QP

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Cable Loss - Preamp Factor
3. Over Limit = Level - Limit Line
4. The emission under 30MHz was not included since the emission levels are very low against the limit.

Site :HY-CB03
Condition :3m ,VERTICAL
Mode :TX 30M-1G
Test BY :Ashton Chiu



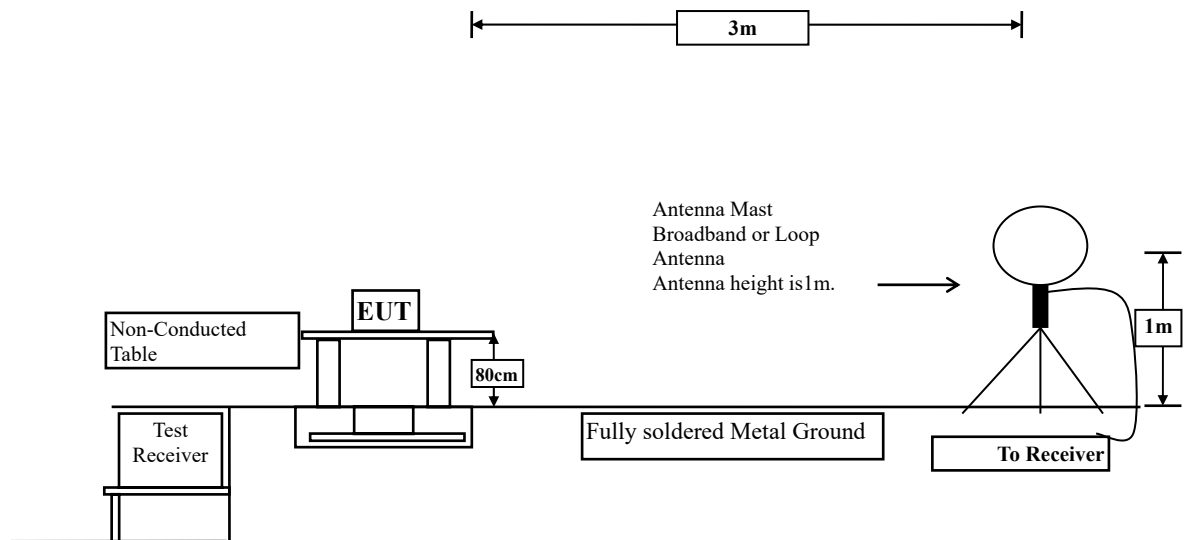
No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	MHz	dBuV/m	Line	Limit	Level		
1	40.670	33.89	40.00	-6.11	58.90	-25.01	QP
2	161.920	32.53	43.50	-10.97	57.74	-25.21	QP
3	352.040	44.91	46.00	-1.09	68.80	-23.89	QP
4	433.520	42.88	46.00	-3.12	64.56	-21.68	QP
5	569.320	35.54	46.00	-10.46	54.68	-19.14	QP
6	729.370	43.80	46.00	-2.20	60.36	-16.56	QP

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Cable Loss - Preamp Factor
3. Over Limit = Level - Limit Line
4. The emission under 30MHz was not included since the emission levels are very low against the limit.

4. Band Edge

4.1. Test Setup

Radiated Emission Under 30MHz



4.2. Limits

The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in Section 15.209. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified in Section 15.209

4.3. Test Procedure

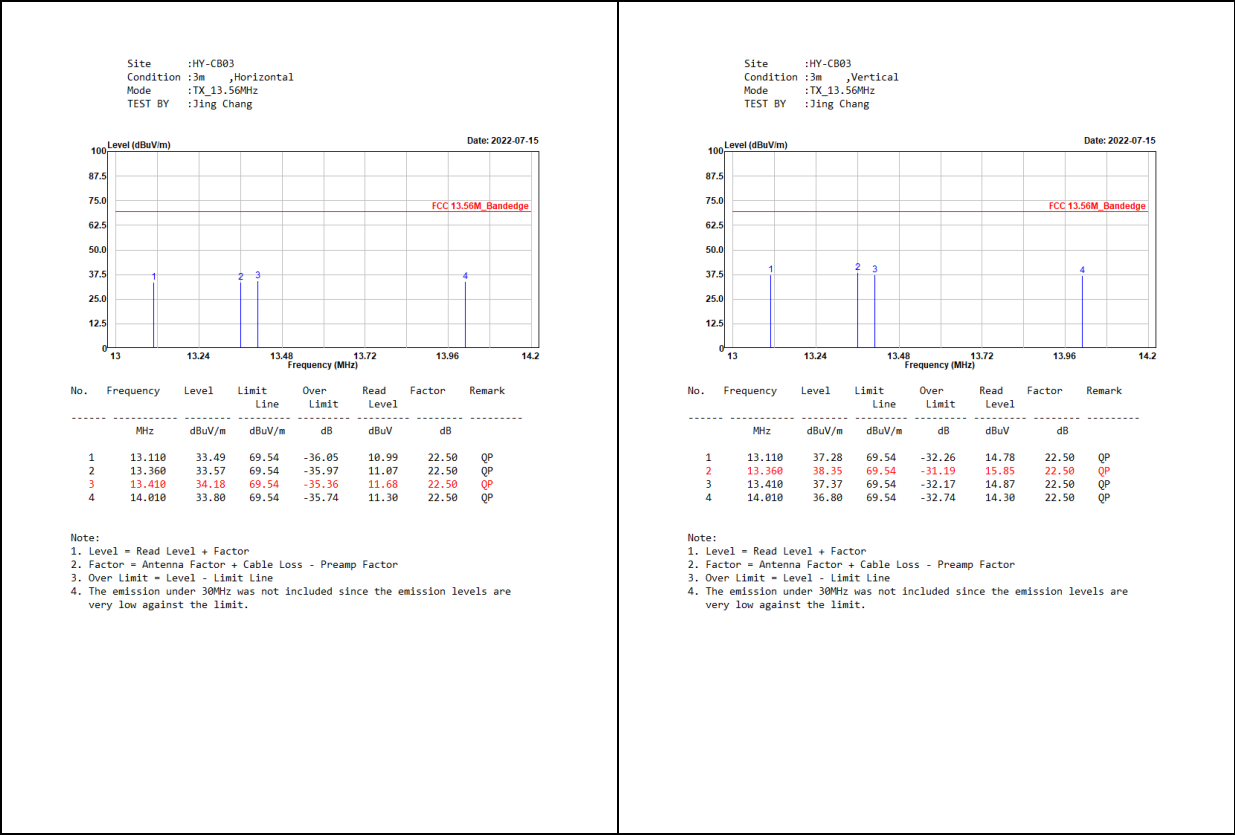
The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level.

The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10: 2013 on radiated measurement.

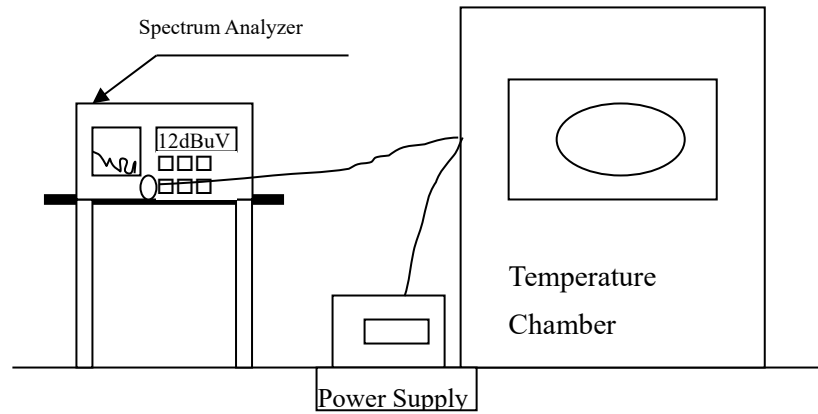
The bandwidth below 30MHz setting on the field strength meter is 9kHz and above 30MHz is 120kHz.

4.4. Test Result of Band Edge



5. Frequency Tolerance

5.1. Test Setup



5.2. Limits

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency.

5.3. Test Procedure

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

5.4. Test Result of Frequency Stability

Product : WC Subsystem Qi. 1.3 Gen.4 3-Coil
 Test Item : Frequency Tolerance
 Test Mode : Mode 1: Transmit
 Test date : 2022/07/12

Temperature (°C)	Voltage (V)	Observe Time	Declared Frequency (MHz)	Read Frequency (MHz)	Tolerance (%)	Limit (%)
20	12	start	13.56	13.55970	-0.002212	±0.01 %
		2mins	13.56	13.55970	-0.002212	
		5mins	13.56	13.55970	-0.002212	
		10mins	13.56	13.55970	-0.002212	
20	13.2	start	13.56	13.55968	-0.002360	±0.01 %
		2mins	13.56	13.55968	-0.002360	
		5mins	13.56	13.55968	-0.002360	
		10mins	13.56	13.55968	-0.002360	
20	10.8	start	13.56	13.55968	-0.002360	±0.01 %
		2mins	13.56	13.55968	-0.002360	
		5mins	13.56	13.55968	-0.002360	
		10mins	13.56	13.55968	-0.002360	
50	12	start	13.56	13.55968	-0.002360	±0.01 %
		2mins	13.56	13.55968	-0.002360	
		5mins	13.56	13.55967	-0.002434	
		10mins	13.56	13.55967	-0.002434	
40	12	start	13.56	13.55968	-0.002360	±0.01 %
		2mins	13.56	13.55968	-0.002360	
		5mins	13.56	13.55968	-0.002360	
		10mins	13.56	13.55967	-0.002434	
30	12	start	13.56	13.55969	-0.002286	±0.01 %
		2mins	13.56	13.55969	-0.002286	
		5mins	13.56	13.55969	-0.002286	
		10mins	13.56	13.55968	-0.002360	

10	12	start	13.56	13.55970	-0.002212	±0.01 %
		2mins	13.56	13.55970	-0.002212	
		5mins	13.56	13.55970	-0.002212	
		10mins	13.56	13.55970	-0.002212	
0	12	start	13.56	13.55970	-0.002212	±0.01 %
		2mins	13.56	13.55970	-0.002212	
		5mins	13.56	13.55969	-0.002286	
		10mins	13.56	13.55969	-0.002286	
-10	12	start	13.56	13.55969	-0.002286	±0.01 %
		2mins	13.56	13.55968	-0.002360	
		5mins	13.56	13.55968	-0.002360	
		10mins	13.56	13.55968	-0.002360	
-20	12	start	13.56	13.55968	-0.002360	±0.01 %
		2mins	13.56	13.55968	-0.002360	
		5mins	13.56	13.55968	-0.002360	
		10mins	13.56	13.55967	-0.002434	