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Test Report

Report No. : CQASZ20200800932E-01

Applicant: MOKO TECHNOLOGY LIMITED

Address of Applicant: 2F, Building1,No.37 Xiaxintang Xintang village, Fucheng Street, Longhua District, Shenzhen, Guangdong Province, China

Manufacturer: MOKO TECHNOLOGY LIMITED

Address of Manufacturer: 2F, Building1,No.37 Xiaxintang Xintang village, Fucheng Street, Longhua District, Shenzhen, Guangdong Province, China

Factory: MOKO TECHNOLOGY LIMITED

Address of Factory: 2F, Building1,No.37 Xiaxintang Xintang village, Fucheng Street, Longhua District, Shenzhen, Guangdong Province, China

Equipment Under Test (EUT):

Product: Bluetooth Module

Model No.: MK01

Brand Name: N/A

FCC ID: 2AO94-MK01

Standards: 47 CFR Part 15, Subpart C

Date of Test: 2020-08-18 to 2020-09-03

Date of Issue: 2020-09-22

Test Result : **PASS***

Tested By:

Jun Li

(Jun Li)

Reviewed By:

Sheek Luo

(Sheek Luo)

Approved By:

Jack Ai

(Jack Ai)



* In the configuration tested, the EUT complied with the standards specified above.

The test report is effective only with both signature and specialized stamp, The result(s) shown in this report refer only to the sample(s) tested. Without written approval of CQA, this report can't be reproduced except in full.

1 Version

Revision History Of Report

Report No.	Version	Description	Issue Date
CQASZ20200800932E-01	Rev.01	Initial report	2020-9-22

2 Test Summary

Test Item	Test Requirement	Test method	Result
Antenna Requirement	47 CFR Part 15, Subpart C Section 15.203/15.247 (c)	ANSI C63.10 2013	PASS
AC Power Line Conducted Emission	47 CFR Part 15, Subpart C Section 15.207	ANSI C63.10 2013	N/A
Conducted Peak & Average Output Power	47 CFR Part 15, Subpart C Section 15.247 (b)(3) KDB 558074	ANSI C63.10 2013	PASS
6dB Occupied Bandwidth	47 CFR Part 15, Subpart C Section 15.247 (a)(2) KDB 558074	ANSI C63.10 2013	PASS
Power Spectral Density	47 CFR Part 15, Subpart C Section 15.247 (e) KDB 558074	ANSI C63.10 2013	PASS
Radiated Spurious Emissions	47 CFR Part 15, Subpart C Section 15.205/15.209 KDB 558074	ANSI C63.10 2013	PASS
Restricted bands around fundamental frequency (Radiated Emission)	47 CFR Part 15, Subpart C Section 15.205/15.209 KDB 558074	ANSI C63.10 2013	PASS

N/A: Not Applicable (Since the product is a single-mode module, the power supply voltage is DC 3.3V; So you don't need to CE test it.)

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4 General Information

4.1 Client Information

Applicant:	MOKO TECHNOLOGY LIMITED
Address of Applicant:	2F, Building1,No.37 Xiaxintang Xintang village, Fucheng Street, Longhua District , Shenzhen,Guangdong Province, China
Manufacturer:	MOKO TECHNOLOGY LIMITED
Address of Manufacturer:	2F, Building1,No.37 Xiaxintang Xintang village, Fucheng Street, Longhua District , Shenzhen,Guangdong Province, China

4.2 General Description of EUT

Product Name:	Bluetooth Module
Model No.:	MK01
Trade Mark:	N/A
Type of Modulation:	BLE(GFSK)
Channel Spacing:	2MHz
Operation Frequency:	2402-2480MHz
Antenna Type:	Ceramic antenna
Antenna:	0.9 dBi gain
Power Supply:	DC 3.3V

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
1	2402	2	2404
3	2406	4	2408
5	2410	6	2412
7	2414	8	2416
9	2418	10	2420
11	2422	12	2424
13	2426	14	2428
15	2430	16	2432
17	2434	18	2436
19	2438	20	2440
21	2442	22	2444
23	2446	24	2448
25	2450	26	2452
27	2454	28	2456
29	2458	30	2460
31	2462	32	2464
33	2466	34	2468
35	2470	36	2472
37	2474	38	2476
39	2478	40	2480

Test mode	Low Channel	Middle Channel	High Channel
BLE(GFSK)	2402MHz	2440MHz	2480MHz

Note:

1. In radiated measurement, the EUT had been pre-scan on the positioned of each 3 axis(X,Y,Z), the worst case was found when positioned on X-plane.

4.3 Description of Support Units

The EUT has been tested with associated equipment below.

Description	Manufacturer	Model No.	Certification	Supplied by
PC	Lenovo	ThinkPad E450c	FCC	CQA

4.4 Test Location

All tests were performed at:

Shenzhen Huaxia Testing Technology Co., Ltd.,

1F., Block A of Tongsheng Technology Building, Huahui Road, Dalang Street, Longhua New District,
Shenzhen, Guangdong, China

4.5 Test Facility

- **A2LA (Certificate No. 4742.01)**

Shenzhen Huaxia Testing Technology Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 4742.01.

- **FCC Registration No.: 522263**

Shenzhen Huaxia Testing Technology Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No.:522263

4.6 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate.

The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities.

The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the **Shenzhen Huaxia Testing Technology Co., Ltd.** quality system acc. to DIN EN ISO/IEC 17025.

Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for CQA laboratory is reported:

No.	Item	Uncertainty	Notes
1	Radiated Emission (Below 1GHz)	5.12dB	(1)
2	Radiated Emission (Above 1GHz)	4.60dB	(1)
3	Conducted Disturbance (0.15~30MHz)	3.34dB	(1)
4	Radio Frequency	3×10^{-8}	(1)
5	Duty cycle	0.6 %.	(1)
6	Occupied Bandwidth	1.1%	(1)
7	RF conducted power	0.86dB	(1)
8	RF power density	0.74	(1)
9	Conducted Spurious emissions	0.86dB	(1)
10	Temperature test	0.8°C	(1)
11	Humidity test	2.0%	(1)
12	Supply voltages	0.5 %.	(1)
13	Frequency Error	5.5 Hz	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

4.7 Deviation from Standards

None.

4.8 Abnormalities from Standard Conditions

None.

4.9 Other Information Requested by the Customer

None.

4.10 Equipment List

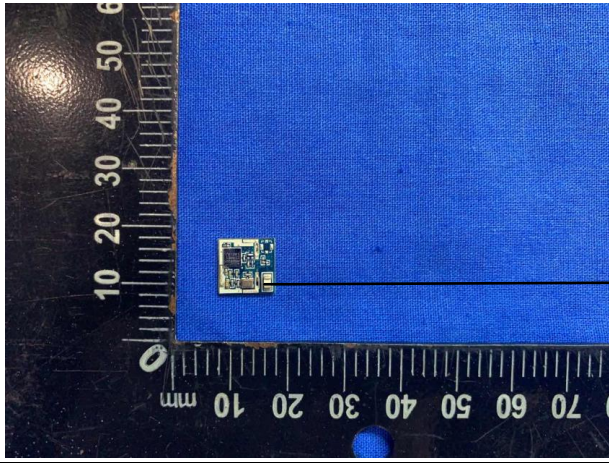
Test Equipment	Manufacturer	Model No.	Instrument No.	Calibration Date	Calibration Due Date
EMI Test Receiver	R&S	ESR7	CQA-005	2019/10/25	2020/10/24
Spectrum analyzer	R&S	FSU26	CQA-038	2019/10/25	2020/10/24
Spectrum Analyzer	Agilent	E4408B	MY4421139	2020/06/20	2021/06/19
Preamplifier	MITEQ	AMF-6D-02001800-29-20P	CQA-036	2019/10/25	2020/10/24
Loop antenna	Schwarzbeck	FMZB1516	CQA-060	2019/10/21	2020/10/20
Bilog Antenna	R&S	HL562	CQA-011	2019/9/26	2020/9/25
Horn Antenna	R&S	HF906	CQA-012	2019/9/26	2020/9/25
Horn Antenna	Schwarzbeck	BBHA 9170	CQA-088	2019/9/25	2020/9/24
Coaxial Cable (Above 1GHz)	CQA	N/A	C007	2019/9/26	2020/9/25
Coaxial Cable (Below 1GHz)	CQA	N/A	C013	2019/9/26	2020/9/25
Antenna Connector	CQA	RFC-01	CQA-080	2019/9/26	2020/9/25
RF cable(9KHz~40GHz)	CQA	RF-01	CQA-079	2019/9/26	2020/9/25
Power divider	MIDWEST	PWD-2533-02-SMA-79	CQA-067	2019/9/26	2020/9/25
DC power	KEYSIGHT	E3631A	CQA-028	2019/9/26	2020/9/25

Note:

The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

5 Test results and Measurement Data

5.1 Antenna Requirement

Standard requirement:	47 CFR Part 15C Section 15.203 /247(c)
<p>15.203 requirement: 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, 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.</p> <p>15.247(b) (4) requirement: 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.</p>	
EUT Antenna:	 <div data-bbox="1230 1249 1422 1391" style="border: 1px solid black; padding: 5px; display: inline-block;">BT Antenna</div>
The antenna is a Ceramic antenna. Antenna Gain : 0.9dBi	

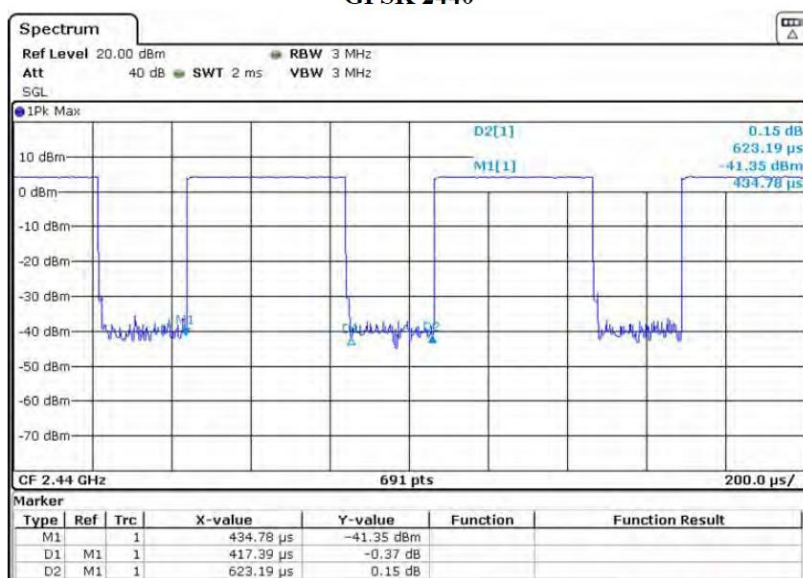
Duty cycle:

Test mode	On time(ms)	Total time(ms)	Duty Cycle	Duty Factor
BLE(GFSK) -TX 2440MHz	0.41739	0.62319	66.98%	1.74

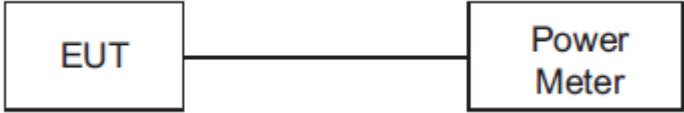
Note:

1. If duty cycle <98 %, the conducted average output power and average power spectral density should be add duty factor.
2. If duty cycle ≥98 %, the EUT is consider to be transmitting continuously, the conducted average output power and average power spectral density no need to add duty factor (consider to be zero).
3. The conducted peak output power and peak power spectral density no need to consider duty factor.
4. The on-time time is transmission duration(T).

GFSK 2440



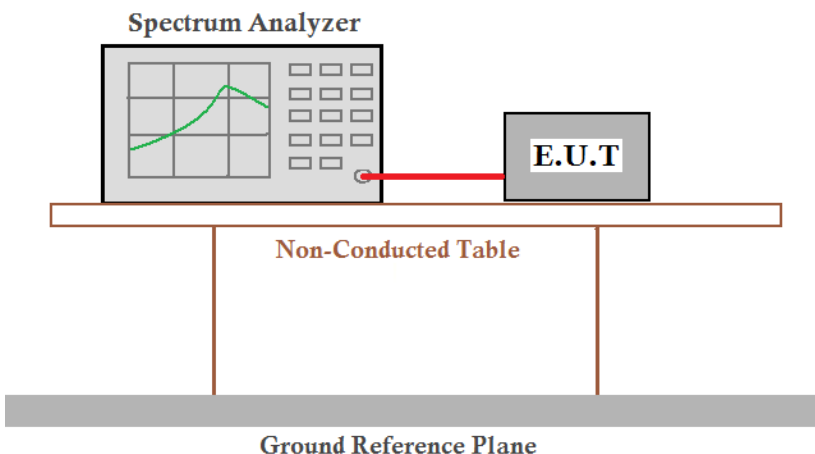
5.2 Conducted Peak Output Power

Test Requirement:	47 CFR Part 15C Section 15.247 (b)(3)
Test Method:	ANSI C63.10: 2013
Test Setup:	 <p>1, Connected the EUT's antenna port to spectrum analyzer device. 2, Follow the test procedure as described in KDB 558074 (1). Set the RBW \geq DTS bandwidth. (2). Set VBW \geq 3 x RBW. (3). Set span \geq 3 x RBW. (4). Sweep time = auto couple. (5). Detector = peak. (6). Trace mode = max hold. (7). Allow trace to fully stabilize. (8). Use peak marker function to determine the peak amplitude level. Note: The cable loss and attenuator loss were offset into measure device as an amplitude offs</p>
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	BLE(GFSK)
Limit:	30dBm
Test Results:	Pass

Measurement Data

Test Mode	CH	Conducted Power (dBm)	Duty Factor	Result (dBm)	Limit (dBm)
BLE(GFSK)	CH1	0.12	1.74	1.86	30
	CH20	2.34	1.74	4.08	30
	CH40	2.95	1.74	4.69	30
Conclusion: PASS					

5.3 6dB Occupy Bandwidth

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(2)
Test Method:	ANSI C63.10: 2013
Test Setup:	 <p>1, Connected the EUT's antenna port to spectrum analyzer device.</p> <p>2, Follow the test procedure as described in KDB 558074</p> <ol style="list-style-type: none"> (1). Set resolution bandwidth (RBW) = 100 kHz. (2). Set the video bandwidth (VBW) $\geq 3 \times$ RBW. (3). Detector = Peak. (4). Trace mode = max hold. (5). Sweep = auto couple. (6). Allow the trace to stabilize. (7). Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	BLE(GFSK)
Limit:	≥ 500 kHz
Test Results:	Pass

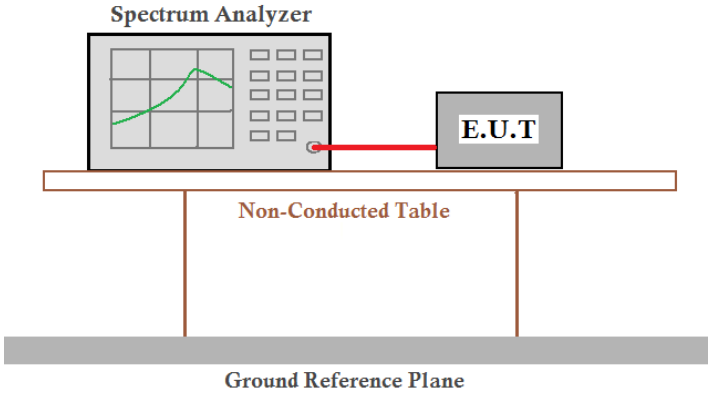
Measurement Data

Test Mode	CH	6dB bandwidth (MHz)	Limit (KHz)
BLE(GFSK)	CH1	0.757	>500
	CH20	0.756	>500
	CH40	0.760	>500
Conclusion: PASS			

Test plot as follows:

Graphs_6dB Occupy Bandwidth	
<p>BLE(GFSK) 2402MHz</p>	 <p>Agilent</p> <p>Ch Freq 2.402 GHz Trig Free</p> <p>Center Freq 2.4020000 GHz</p> <p>Start Freq 2.3970000 GHz</p> <p>Stop Freq 2.4070000 GHz</p> <p>CF Step 1.0000000 MHz Auto Man</p> <p>Freq Offset 0.0000000 Hz</p> <p>Signal Track On Off</p> <p>Ref 10 dBm Atten 20 dB</p> <p>#Peak Log 10 dB/</p> <p>Center 2.402 GHz Span 10 MHz</p> <p>#Res BW 100 kHz #VBW 300 kHz Sweep 4 ms (401 pts)</p> <p>Occupied Bandwidth 1.0711 MHz</p> <p>Occ BW % Pwr 99.00 % x dB -6.00 dB</p> <p>Transmit Freq Error -13.512 kHz</p> <p>x dB Bandwidth 757.420 kHz</p>
<p>BLE(GFSK) 2440MHz</p>	 <p>Agilent</p> <p>Ch Freq 2.44 GHz Trig Free</p> <p>Center Freq 2.4400000 GHz</p> <p>Start Freq 2.4350000 GHz</p> <p>Stop Freq 2.4450000 GHz</p> <p>CF Step 1.0000000 MHz Auto Man</p> <p>Freq Offset 0.0000000 Hz</p> <p>Signal Track On Off</p> <p>Ref 10 dBm Atten 20 dB</p> <p>#Peak Log 10 dB/</p> <p>Center 2.44 GHz Span 10 MHz</p> <p>#Res BW 100 kHz #VBW 300 kHz Sweep 4 ms (401 pts)</p> <p>Occupied Bandwidth 1.0761 MHz</p> <p>Occ BW % Pwr 99.00 % x dB -6.00 dB</p> <p>Transmit Freq Error -16.530 kHz</p> <p>x dB Bandwidth 755.486 kHz</p>
<p>BLE(GFSK) 2480MHz</p>	 <p>Agilent</p> <p>Ch Freq 2.48 GHz Trig Free</p> <p>Center Freq 2.4800000 GHz</p> <p>Start Freq 2.4750000 GHz</p> <p>Stop Freq 2.4850000 GHz</p> <p>CF Step 1.0000000 MHz Auto Man</p> <p>Freq Offset 0.0000000 Hz</p> <p>Signal Track On Off</p> <p>Ref 10 dBm Atten 20 dB</p> <p>#Peak Log 10 dB/</p> <p>Center 2.48 GHz Span 10 MHz</p> <p>#Res BW 100 kHz #VBW 300 kHz Sweep 4 ms (401 pts)</p> <p>Occupied Bandwidth 1.0777 MHz</p> <p>Occ BW % Pwr 99.00 % x dB -6.00 dB</p> <p>Transmit Freq Error -18.440 kHz</p> <p>x dB Bandwidth 759.646 kHz</p>

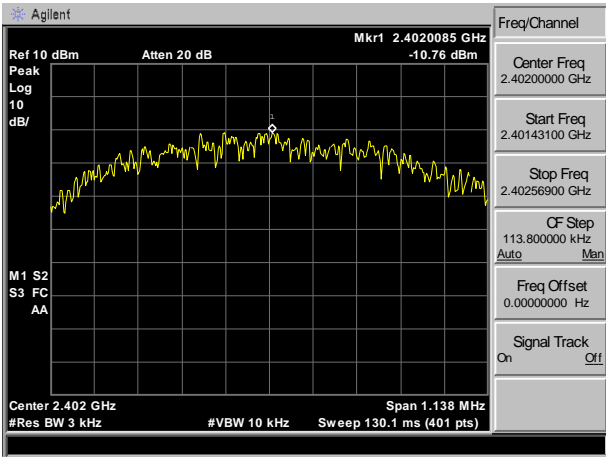
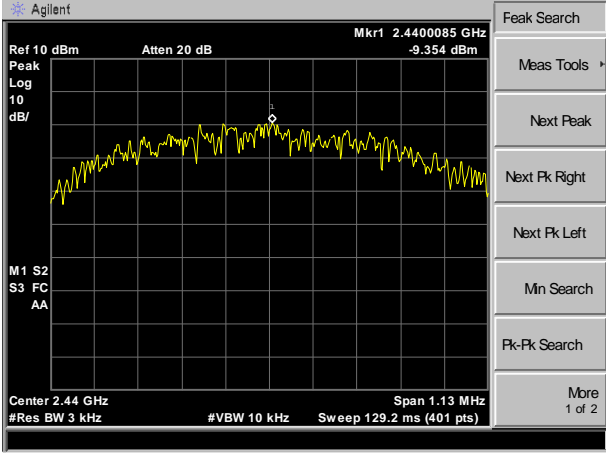
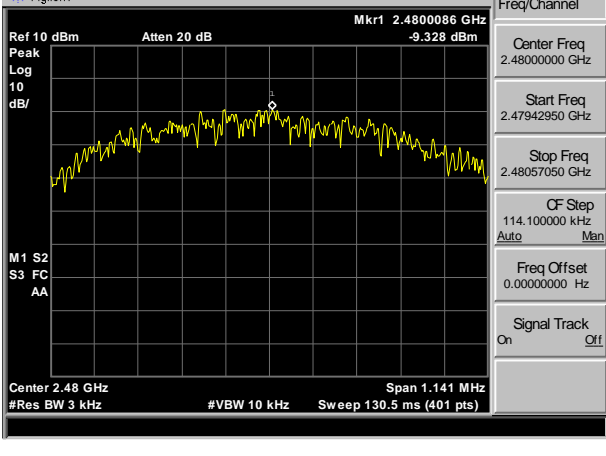
5.4 Power Spectral Density

Test Requirement:	47 CFR Part 15C Section 15.247 (e)
Test Method:	ANSI C63.10: 2013
Test Setup:	 <p>1, Connected the EUT's antenna port to spectrum analyzer device. 2, Follow the test procedure as described in KDB 558074 (1). Set analyzer center frequency to DTS channel center frequency. (2). Set the span to 1.5 times the DTS bandwidth. (3). Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$. (4). Set the VBW $\geq 3 \text{ RBW}$. (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 amplitude level. (10). If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.</p>
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	BLE(GFSK)
Limit:	$\leq 8.00 \text{ dBm/3kHz}$
Test Results:	Pass

Measurement Data

Test Mode	CH	Power density (dBm/3kHz)	Duty Factor	Result (dBm/3kHz)	(dBm/3kHz) Limit Limit
GFSK(BLE)	CH1	-10.76	1.74	-9.02	8
	CH20	-9.35	1.74	-7.61	8
	CH40	-9.33	1.74	-7.59	8
Conclusion: PASS					

Test plot as follows:

Graphs	
BLE(GFSK) 2402MHz	 <p>Agilent spectrum analyzer screenshot for BLE(GFSK) at 2402MHz. The plot shows a signal with a peak at 2.4020085 GHz and -10.76 dBm. The center frequency is 2.402 GHz, span is 1.138 MHz, and resolution bandwidth is 3 kHz. The interface includes a 'Freq/Channel' panel on the right with settings for Center Freq, Start Freq, Stop Freq, CF Step, Freq Offset, and Signal Track.</p>
BLE(GFSK) 2440MHz	 <p>Agilent spectrum analyzer screenshot for BLE(GFSK) at 2440MHz. The plot shows a signal with a peak at 2.4400085 GHz and -9.354 dBm. The center frequency is 2.44 GHz, span is 1.13 MHz, and resolution bandwidth is 3 kHz. The interface includes a 'Peak Search' panel on the right with various search and measurement tools.</p>
BLE(GFSK) 2480MHz	 <p>Agilent spectrum analyzer screenshot for BLE(GFSK) at 2480MHz. The plot shows a signal with a peak at 2.4800086 GHz and -9.328 dBm. The center frequency is 2.48 GHz, span is 1.141 MHz, and resolution bandwidth is 3 kHz. The interface includes a 'Freq/Channel' panel on the right with settings for Center Freq, Start Freq, Stop Freq, CF Step, Freq Offset, and Signal Track.</p>

5.5 Radiated Spurious Emissions

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205				
Test Method:	ANSI C63.10 2013				
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)				
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak
	0.009MHz-0.090MHz	Average	10kHz	30kHz	Average
	0.090MHz-0.110MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak
	0.110MHz-0.490MHz	Average	10kHz	30kHz	Average
	0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	30MHz-1GHz	Quasi-peak	100 kHz	300kHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
		Peak	1MHz	10Hz	Average
Limit:	Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz-88MHz	100	40.0	Quasi-peak	3
	88MHz-216MHz	150	43.5	Quasi-peak	3
	216MHz-960MHz	200	46.0	Quasi-peak	3
	960MHz-1GHz	500	54.0	Quasi-peak	3
	Above 1GHz	500	54.0	Average	3
	Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.				

Test Setup:

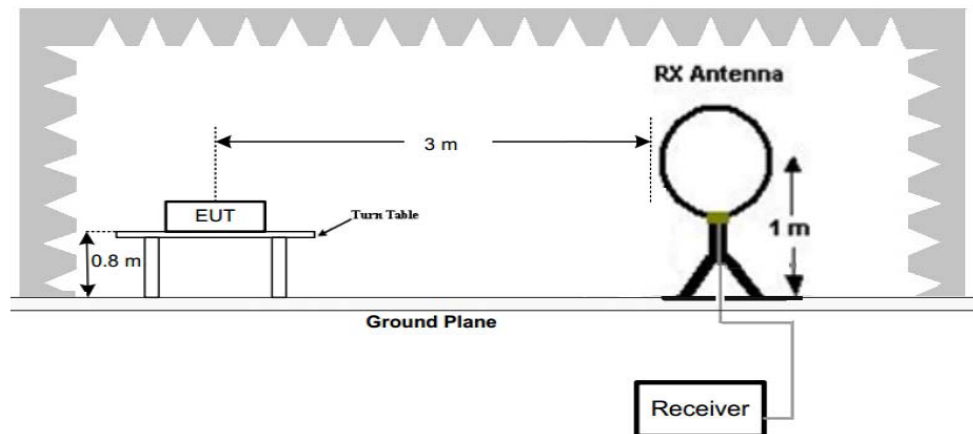


Figure 1. Below 30MHz

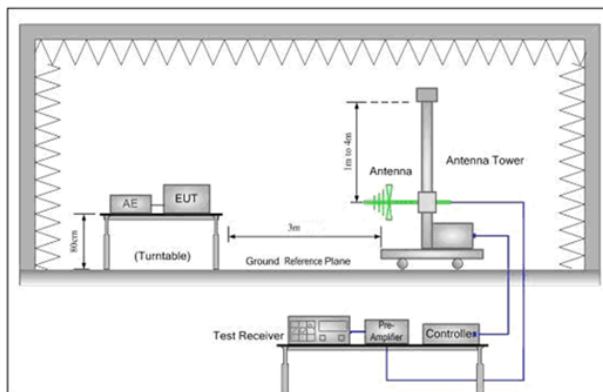


Figure 2. 30MHz to 1GHz

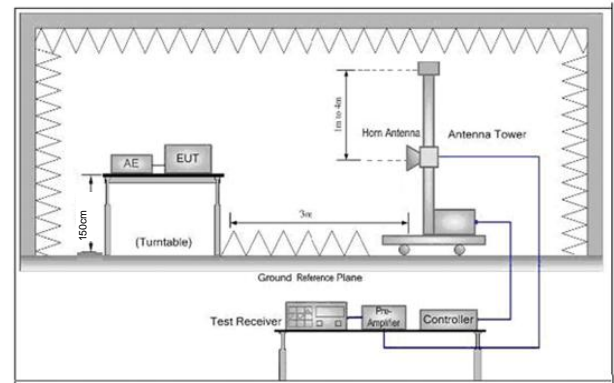


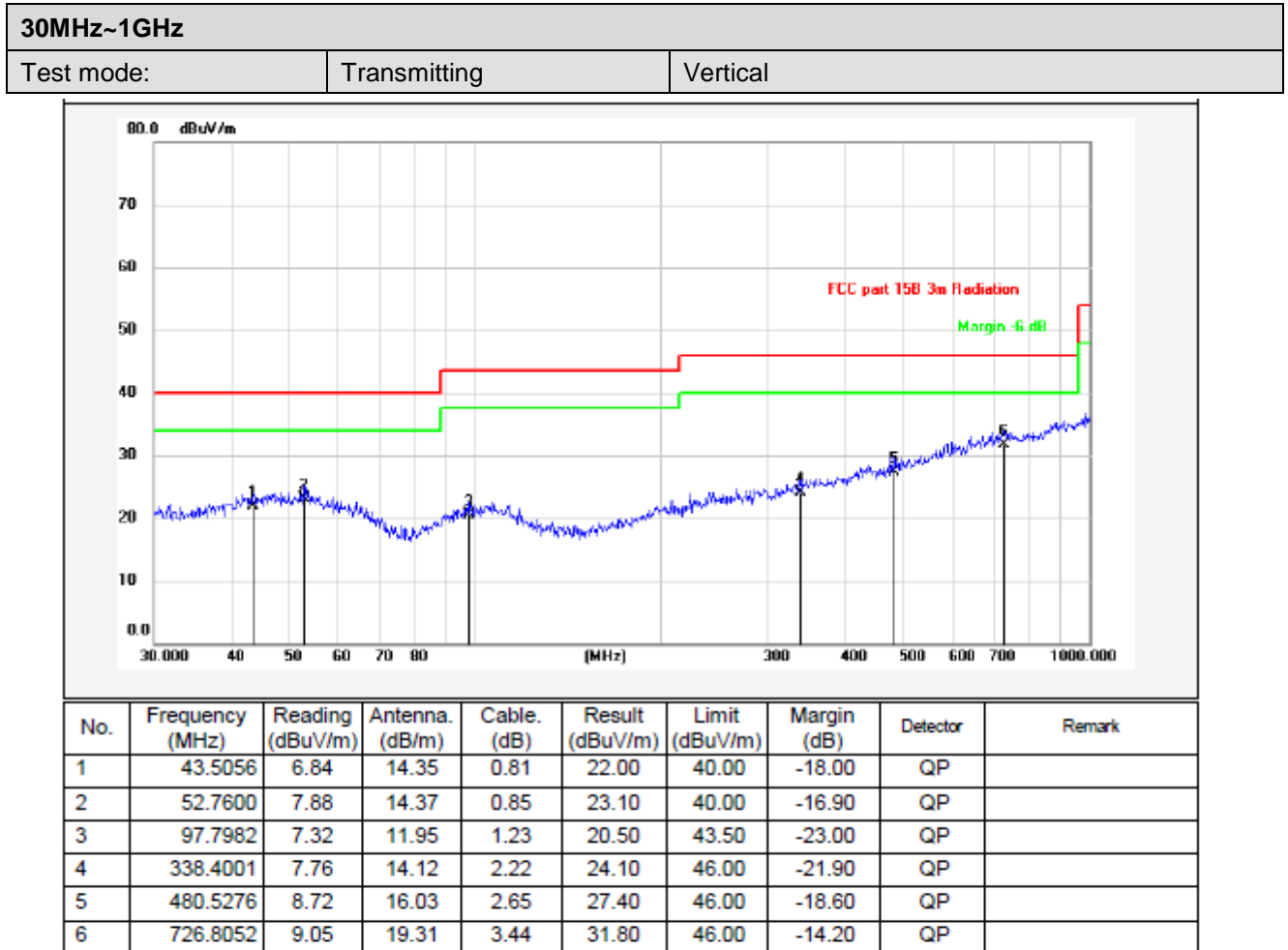
Figure 3. Above 1 GHz

Test Procedure:

- a. 1) Below 1G: The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
2) Above 1G: The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
Note: For the radiated emission test above 1GHz:
Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for

	<p>the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.</p> <p>e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</p> <p>f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.</p> <p>g. Test the EUT in the lowest channel ,the middle channel ,the Highest channel</p> <p>h. Repeat above procedures until all frequencies measured was complete.</p>
Exploratory Test Mode:	<p>Transmitting with all kind of modulations, data rates.</p> <p>Transmitting mode.</p>
Final Test Mode:	<p>BLE(GFSK)</p> <p>Only the worst case is recorded in the report.</p>
Test Results:	Pass

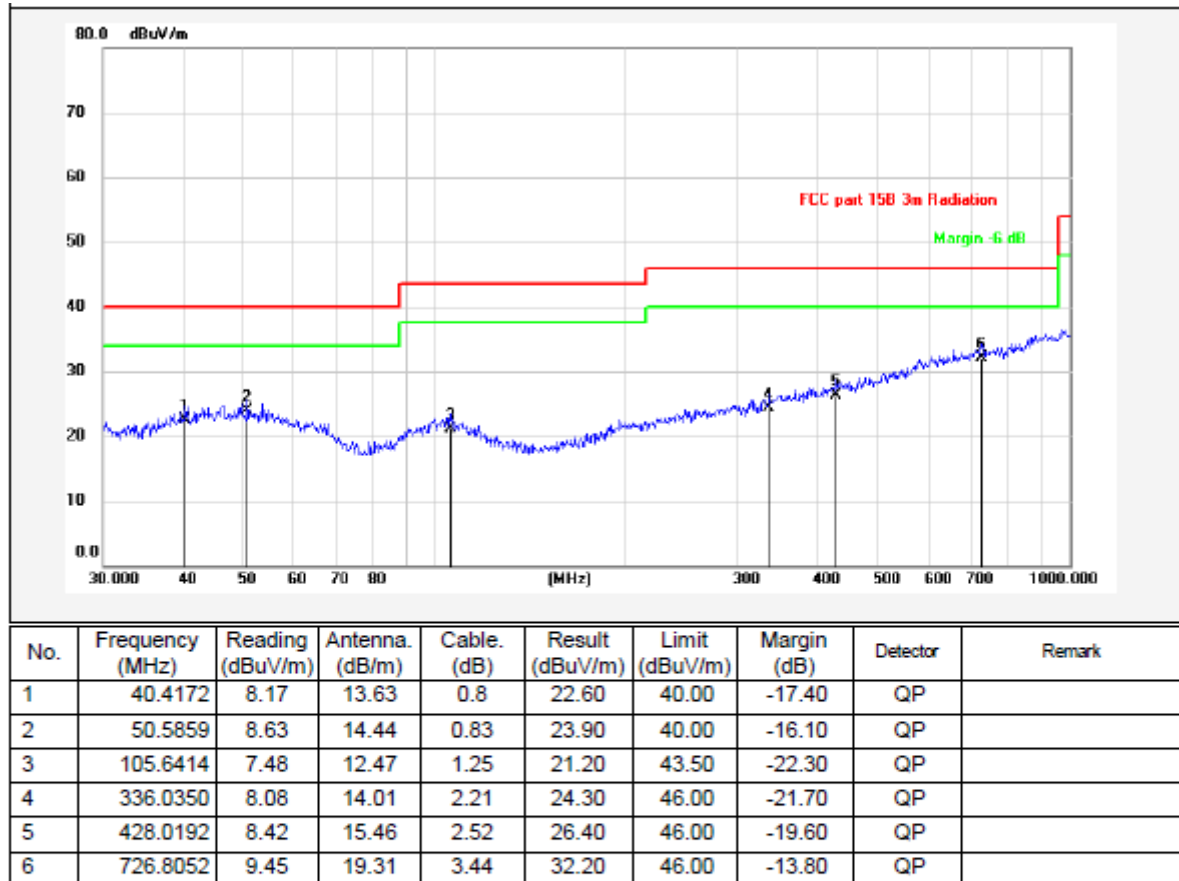
5.5.1 Radiated emission below 1GHz



Remarks: 1. Result=Reading+Antenna+Cable

2. If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.

Test mode:	Transmitting	Horizontal
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Remarks: 1. Result=Reading+Antenna+Cable

2. If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.

5.5.2 Transmitter emission above 1GHz

Test mode: BLE(GFSK)		2402MHz		Test channel:		Lowest	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
4804.000	59.63	-4.12	55.51	74	-18.49	peak	H
4804.000	46.01	-4.12	41.89	54	-12.11	AVG	H
7206.000	51.23	1.46	52.69	74	-21.31	peak	H
7206.000	37.66	1.46	39.12	54	-14.88	AVG	H
4804.000	60.36	-4.12	56.24	74	-17.76	peak	V
4804.000	50.01	-4.12	45.89	54	-8.11	AVG	V
7206.000	49.11	1.46	50.57	74	-23.43	peak	V
7206.000	39.86	1.46	38.40	54	-15.60	AVG	V

Test mode: BLE(GFSK)		2440MHz		Test channel:		Middle	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
4880.000	61.03	-4.03	57.00	74	-17.00	peak	H
4880.000	50.45	-4.03	46.42	54	-7.58	AVG	H
7320.000	53.06	1.66	54.72	74	-19.28	peak	H
7320.000	40.04	1.66	41.70	54	-12.30	AVG	H
4880.000	59.99	-4.03	55.96	74	-18.04	peak	V
4880.000	42.86	-4.03	38.83	54	-15.17	AVG	V
7320.000	48.69	1.66	50.35	74	-23.65	peak	V
7320.000	36.40	1.66	38.06	54	-15.94	AVG	V

Test mode: BLE(GFSK)		2480MHz		Test channel:		Highest	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
4960.000	61.39	-4.26	57.13	74	-16.87	peak	H
4960.000	49.77	-4.26	45.51	54	-8.49	AVG	H
7440.000	53.11	1.18	54.29	74	-19.71	peak	H
7440.000	42.01	1.18	43.19	54	-10.81	AVG	H
4960.000	60.96	-4.26	56.70	74	-17.30	peak	V
4960.000	46.79	-4.26	42.53	54	-11.47	AVG	V
7440.000	51.33	1.18	52.51	74	-21.49	peak	V
7440.000	39.66	1.18	40.84	54	-13.16	AVG	V

Remark:

- 1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level = Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor

- 2) Scan from 9kHz to 25GHz, The disturbance above 13GHz and below 30MHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

5.6 Restricted bands around fundamental frequency

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205		
Test Method:	ANSI C63.10 2013		
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)		
Limit:	Frequency	Limit (dBuV/m @3m)	Remark
	30MHz-88MHz	40.0	Quasi-peak Value
	88MHz-216MHz	43.5	Quasi-peak Value
	216MHz-960MHz	46.0	Quasi-peak Value
	960MHz-1GHz	54.0	Quasi-peak Value
	Above 1GHz	54.0	Average Value
		74.0	Peak Value

Test Setup:

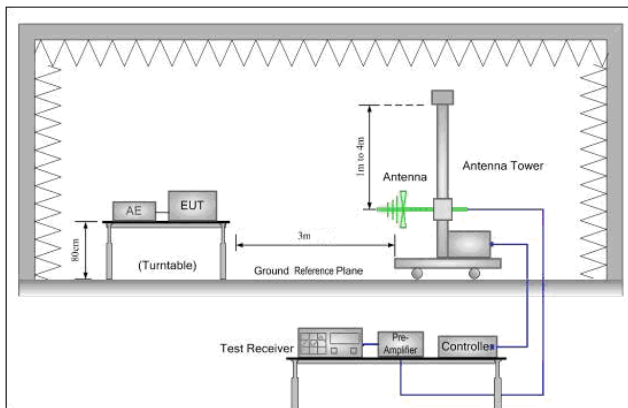


Figure 1. 30MHz to 1GHz

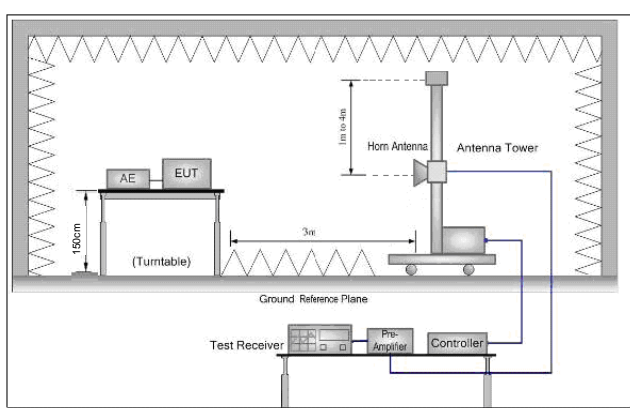


Figure 2. Above 1 GHz

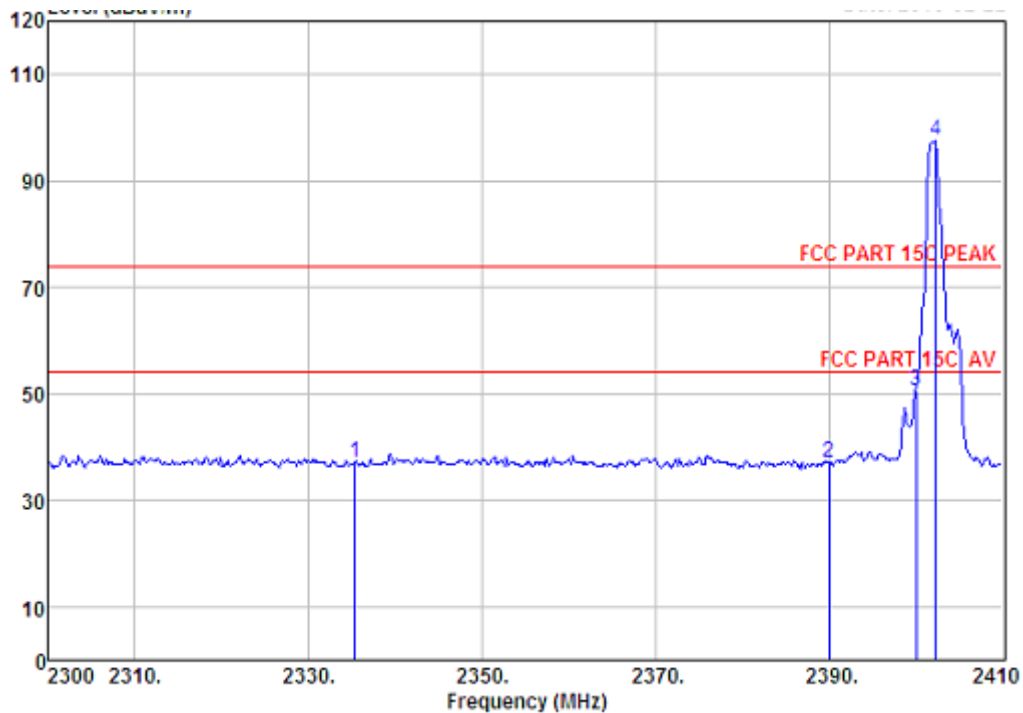
Test Procedure:

- 1) Below 1G: The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
 - 2) Above 1G: The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- Note: For the radiated emission test above 1GHz:
- Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
 - The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

	<p>d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.</p> <p>e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</p> <p>f. Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel</p> <p>g. Test the EUT in the lowest channel , the Highest channel</p> <p>h. Repeat above procedures until all frequencies measured was complete.</p>
Exploratory Test Mode:	<p>Transmitting with all kind of modulations, data rates.</p> <p>Transmitting mode.</p>
Final Test Mode:	<p>BLE(GFSK)</p> <p>Only the worst case is recorded in the report.</p>
Test Results:	Pass

Test data:

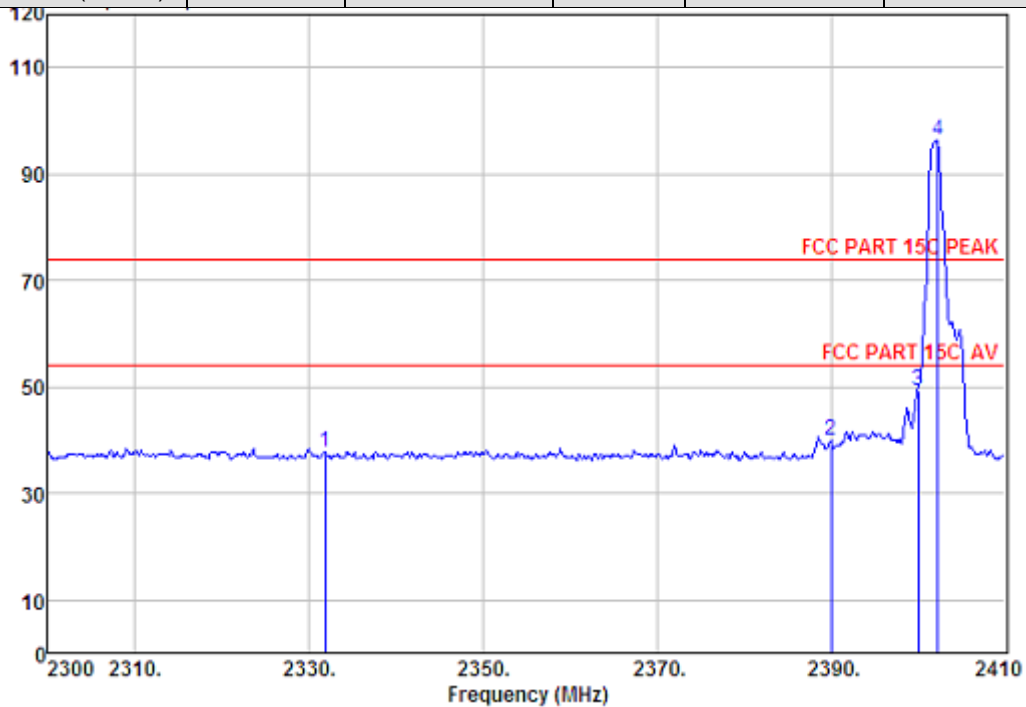
Test mode: BLE(GFSK)	2402MHz	Test channel:	Lowest	Polarization	Horizontal
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	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2335.31	27.73	6.56	34.59	37.27	36.97	74.00	37.03	Peak
2	2390.00	27.64	6.62	34.62	37.55	37.19	74.00	36.81	Peak
3	2400.00	27.61	6.62	34.64	51.09	50.68	74.00	23.32	Peak
4	2402.30	27.61	6.62	34.64	98.16	97.75	74.00	-23.75	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

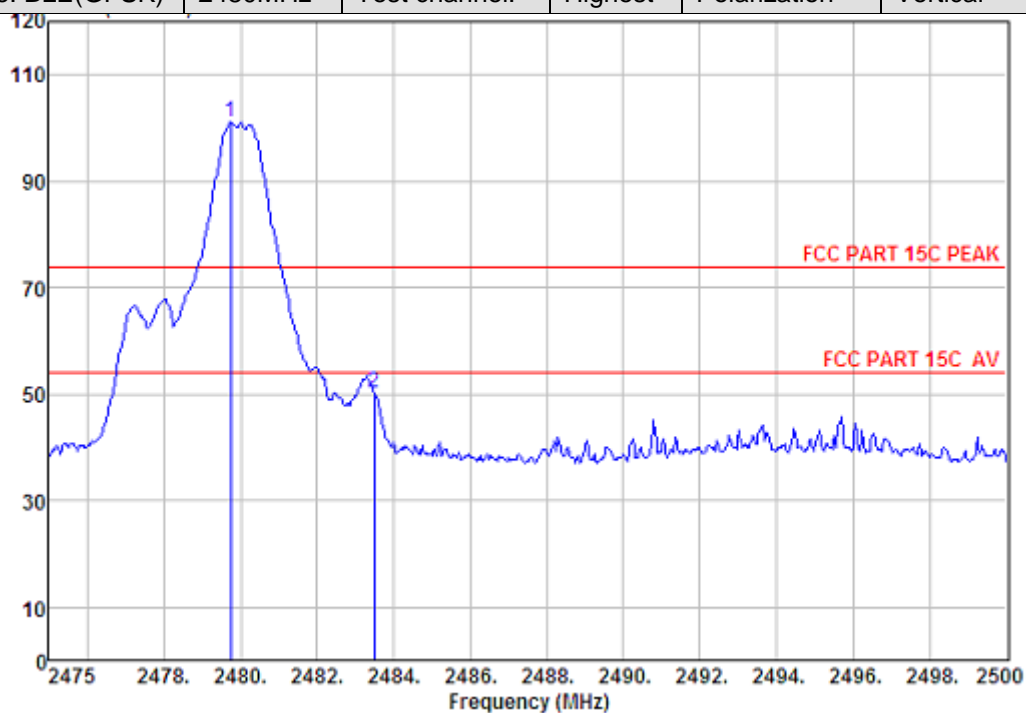
Test mode: BLE(GFSK)	2402MHz	Test channel:	Lowest	Polarization	Vertical
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	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2331.90	27.73	6.54	34.59	37.94	37.62	74.00	36.38	Peak
2	2390.00	27.64	6.62	34.62	40.39	40.03	74.00	33.97	Peak
3	2400.00	27.61	6.62	34.64	49.69	49.28	74.00	24.72	Peak
4	2402.30	27.61	6.62	34.64	96.81	96.40	74.00	-22.40	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

Test mode: BLE(GFSK)	2480MHz	Test channel:	Highest	Polarization	Vertical
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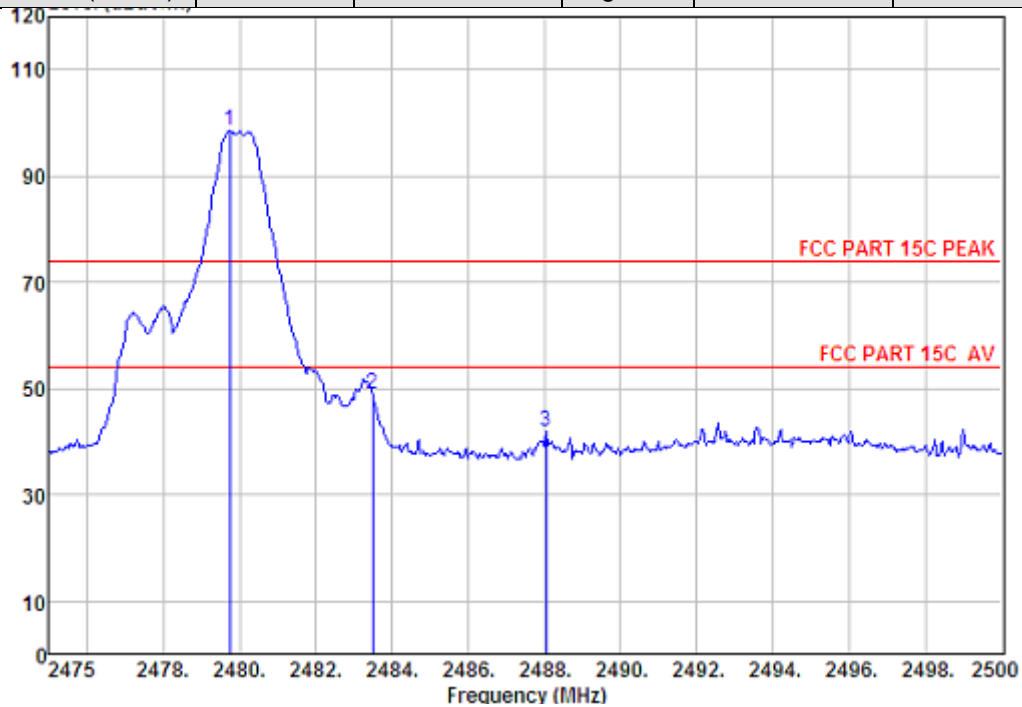


	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2479.75	27.58	6.71	35.11	102.06	101.24	74.00	-27.24	Peak
2	2483.50	27.58	6.71	35.11	50.92	50.10	74.00	23.90	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.

2. The emission levels that are 20dB below the official limit are not reported.

Test mode: BLE(GFSK)	2480MHz	Test channel:	Highest	Polarization	Horizontal
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	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2479.75	27.58	6.71	35.11	99.50	96.68	74.00	-24.68	Peak
2	2483.50	27.58	6.71	35.11	49.62	48.80	74.00	25.20	Peak
3	2488.05	27.58	6.73	35.11	42.58	41.78	74.00	32.22	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

6 Photographs - EUT Test Setup

6.1 Radiated Spurious Emission

30MHz~1GHz:

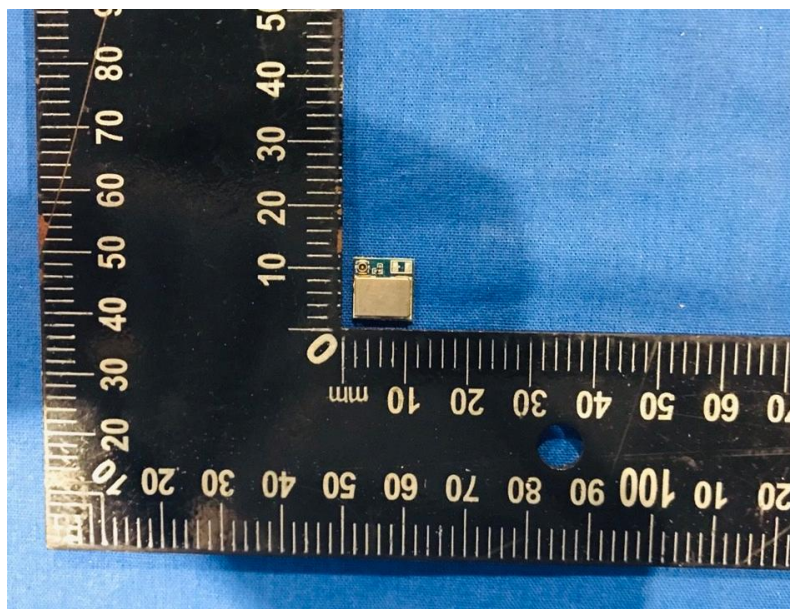
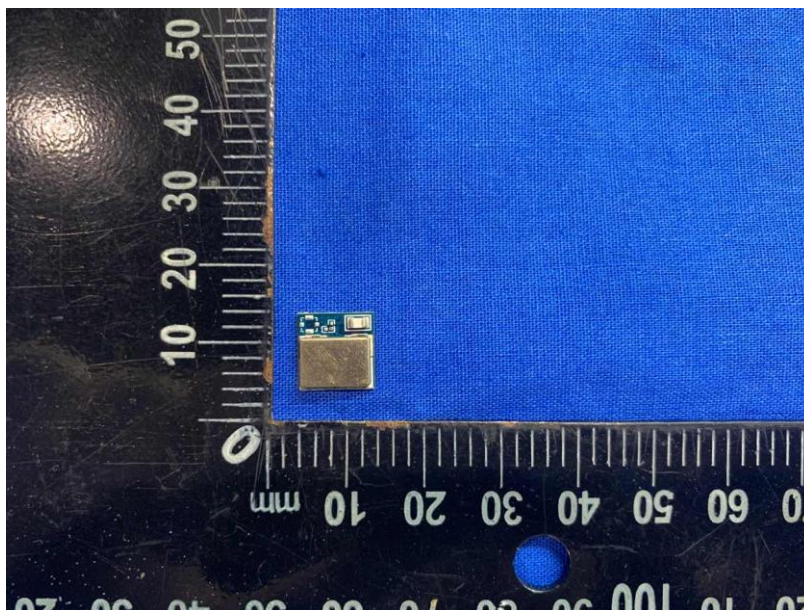


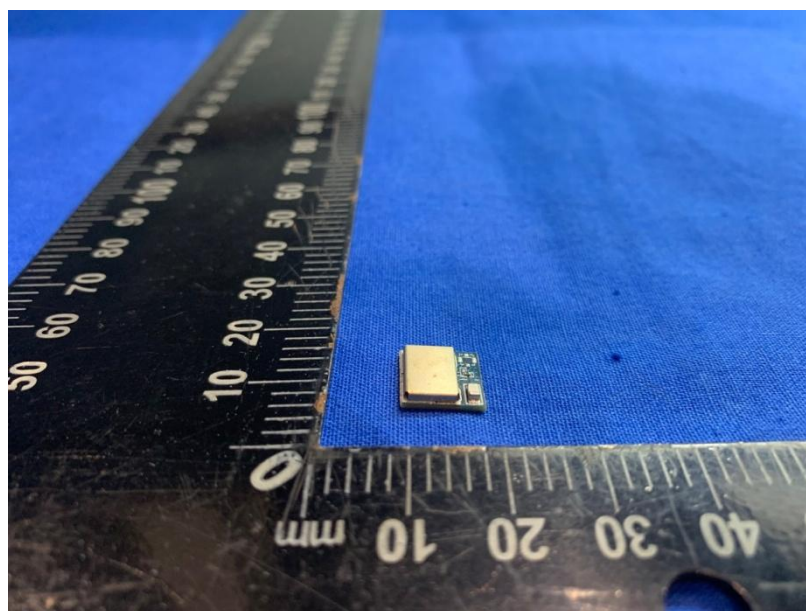
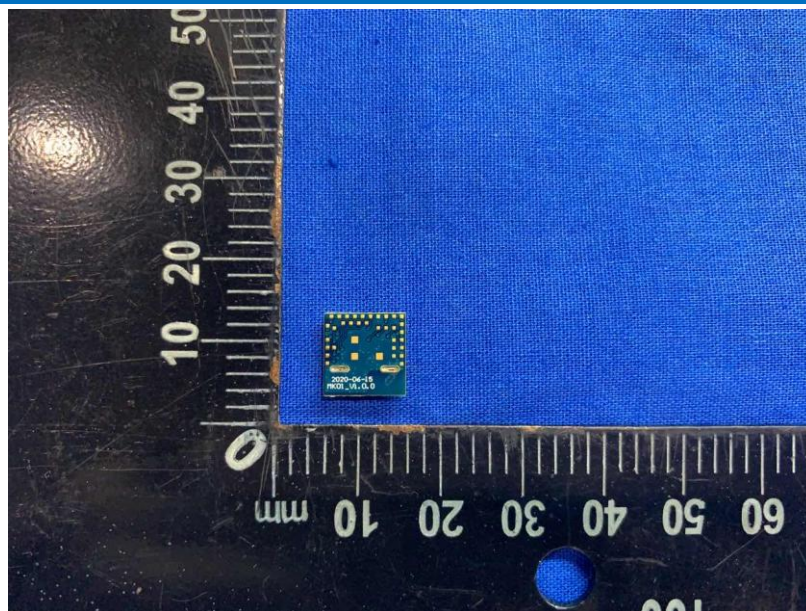
Above 1GHz:

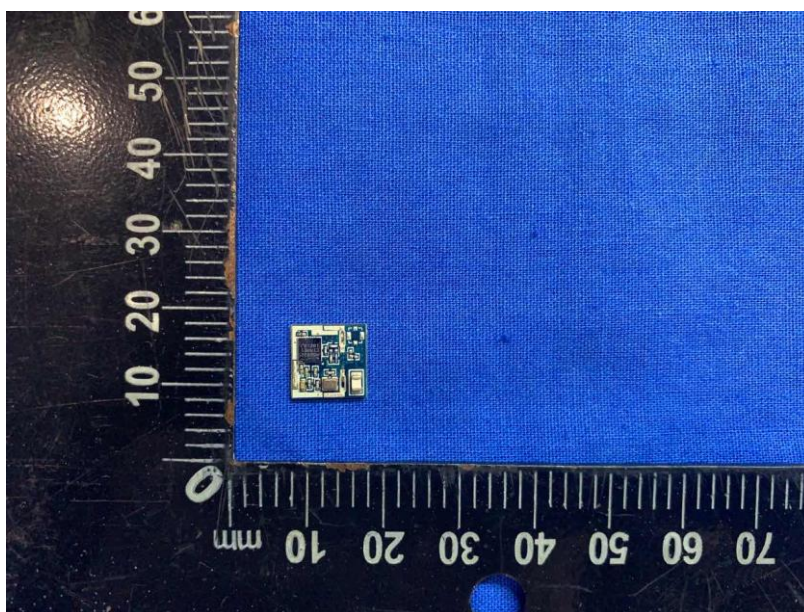
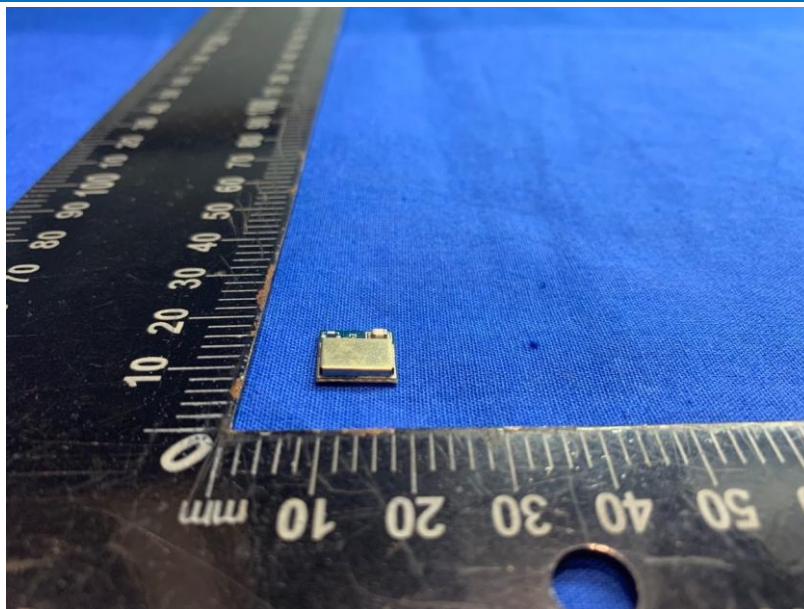


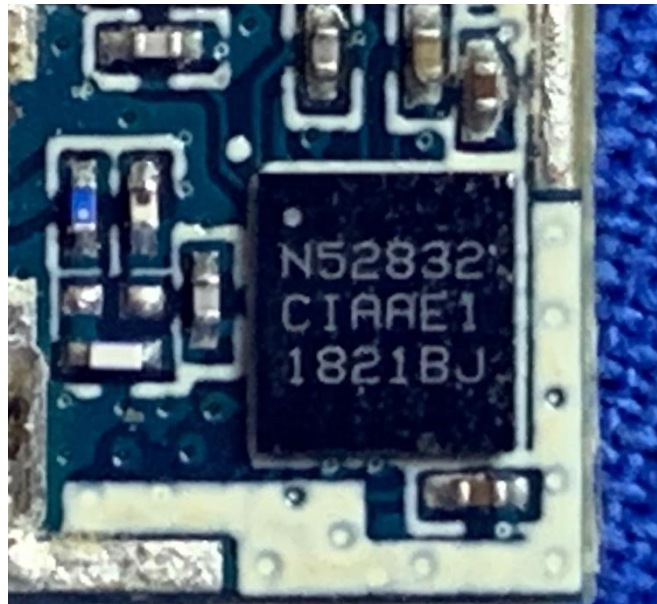
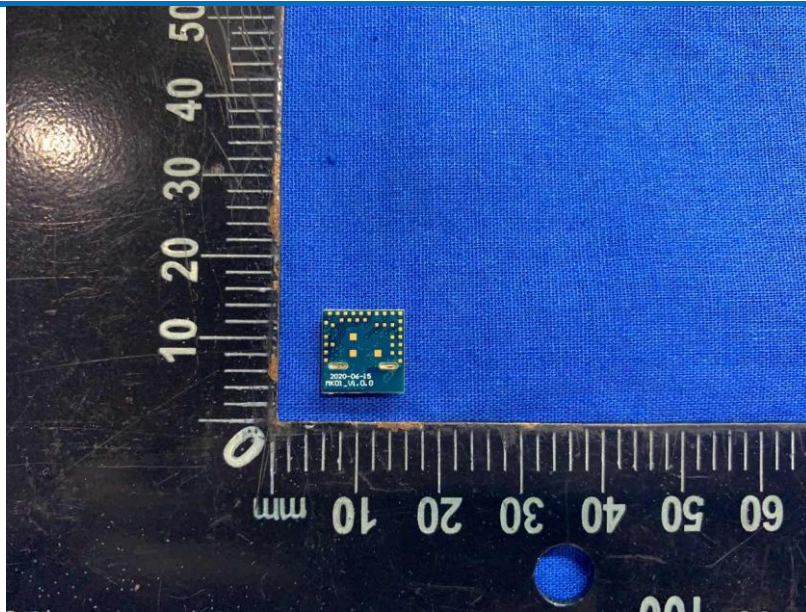
7 Photographs - EUT Constructional Details

Test model No.: MK01









THE END