ISED Test Report

Report No.: AGC00941200301CE02

IC	:	25818-RUUVITAG
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION	:	Open-Source Sensor Beacon
BRAND NAME	:	Ruuvi
MODEL NAME	:	RUUVITAG
CLIENT	:	Ruuvi Innovations Ltd.
DATE OF ISSUE	:	Apr. 28, 2020
STANDARD(S)	:	RSS-GEN: issue 5 RSS-247: issue 2
REPORT VERSION	:	V1.0

Attestation of ***G***lobal ***C***ompliance (Shenzhen) Co., Ltd

REPORT REVISE RECORD

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Apr. 28, 2020	Valid	Initial Release

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1. VERIFICATION OF COMPLIANCE

Applicant	Ruuvi Innovations Ltd.
Address	PL22, C/O KT, 11101 Riihimäki, Finland
Manufacturer	Ruuvi Innovations Ltd.
Address	PL22, C/O KT, 11101 Riihimäki, Finland
Factory	Ruuvi Innovations Ltd.
Address	PL22, C/O KT, 11101 Riihimäki, Finland
Product Designation	Open-Source Sensor Beacon
Brand Name	Ruuvi
Test Model	RUUVITAG
Date of test	Mar. 04, 2020~Apr. 28, 2020
Deviation	None
Condition of Test Sample	Normal
Test Result	Pass
Report Template	AGCRT-US-BLE/RF

We hereby certify that:
The above equipment was tested by Attestation of Global Compliance (Shenzhen) Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with radiated emission limits of RSS-247.

Prepared By

Donjon Huang
(Project Engineer) Apr. 28, 2020

Reviewed By

Max Zhang
(Reviewer) Apr. 28, 2020

Approved By

Forrest Lei
(Authorized Officer) Apr. 28, 2020

2.GENERAL INFORMATION

2.1PRODUCT DESCRIPTION

The EUT is designed as a “Open-Source Sensor Beacon”. It is designed by way of utilizing the GFSK technology to achieve the system operation.

A major technical description of EUT is described as following

Operation Frequency	2.402 GHz to 2.480GHz
RF Output Power	3.781dBm(Max)
Bluetooth Version	V 5.0
Modulation	BR ☐GFSK, EDR ☐π /4-DQPSK, ☐8DPSK BLE ☒GFSK 1Mbps ☒GFSK 2Mbps
Number of channels	40 Channel
Antenna Designation	PCB Antenna(Comply with the requirements of RSS-GEN chapter 6.8)
Antenna Gain	0dBi
Hardware Version	B7.1
Software Version	V1.0
Power Supply	DC 3V by battery

2.2. TABLE OF CARRIER FREQUENCYS

Frequency Band	Channel Number	Frequency
2400~2483.5MHz	0	2402MHz
	1	2404MHz
	:	:
	38	2478 MHz
	39	2480 MHz

2.3 RELATED SUBMITTAL(S)/GRANT(S)

This submittal(s) (test report) is intended for **IC: 25818-RUUVITAG** filing to comply with the RSS-247 requirements.

2.4TEST METHODOLOGY

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10 (2013). Radiated testing was performed at an antenna to EUT distance 3 meters.

2.5 SPECIAL ACCESSORIES

Refer to section 2.2.

2.6 EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

3. MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement y ±U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

- Uncertainty of Conducted Emission, Uc = ±3.2 dB
- Uncertainty of Radiated Emission below 1GHz, Uc = ±3.9 dB
- Uncertainty of Radiated Emission above 1GHz, Uc = ±4.8 dB
- Uncertainty of total RF power, conducted, Uc = ±0.8dB
- Uncertainty of RF power density, conducted, Uc = ±2.6dB
- Uncertainty of spurious emissions, conducted, Uc = ±2.7dB
- Uncertainty of Occupied Channel Bandwidth: Uc = ±2 %

4. DESCRIPTION OF TEST MODES

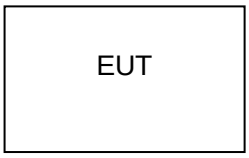
NO.	TEST MODE DESCRIPTION
1	Low channel TX
2	Middle channel TX
3	High channel TX

Note:

1. Only the result of the worst case was recorded in the report, if no other cases.
2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.
3. For Conducted Test method, a temporary antenna connector is provided by the manufacture.
4. EUT connects the computer through the serial port tool (USB TO TTL), and then enters the test mode through the test software **nRFgo Studio.**

5. SYSTEM TEST CONFIGURATION

5.1 CONFIGURATION OF TESTED SYSTEM



5.2 EQUIPMENT USED IN TESTED SYSTEM

Item	Equipment	Model No.	ID or Specification	Remark
1	Open-Source Sensor Beacon	RUUVITAG	25818-RUUVITAG	EUT

5.3. SUMMARY OF TEST RESULTS

ISED RULES	DESCRIPTION OF TEST	RESULT
RSS-247 5.4(d)	Peak Output Power	Compliant
RSS-247 5.2(a)	6 dB Bandwidth	Compliant
RSS-247 5.5	Conducted Spurious Emission	Compliant
RSS-247 5.2(b)	Maximum Conducted Output Power Density	Compliant
RSS-GEN 8.9	Radiated Emission	Compliant
RSS-GEN 8.8	Conducted Emission	NA

6. TEST FACILITY

Test Site	Attestation of Global Compliance (Shenzhen) Co., Ltd
Location	1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
IC Designation Number	24842
A2LA Cert. No.	5054.02
Description	Attestation of Global Compliance(Shenzhen) Co., Ltd is accredited by A2LA

TEST EQUIPMENT OF RADIATED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESCI	10096	Jun. 12, 2019	Jun. 11, 2020
EXA Signal Analyzer	Aglient	N9010A	MY53470504	Dec. 18, 2019	Dec. 17, 2020
2.4GHz Fliter	EM Electronics	2400-2500MHz	N/A	Feb. 26, 2020	Feb. 25, 2021
Attenuator	ZHINAN	E-002	N/A	Aug. 26, 2019	Aug. 25, 2020
Horn antenna	SCHWARZBECK	BBHA 9170	#768	Sep. 09, 2019	Sep. 08, 2021
Active loop antenna (9K-30MHz)	ZHINAN	ZN30900C	18051	Jun. 14, 2018	Jun. 13, 2020
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	May. 26, 2018	May. 25, 2020
Broadband Preamplifier	ETS LINDGREN	3117PA	00225134	Oct. 15, 2019	Oct. 14, 2020
ANTENNA	SCHWARZBECK	VULB9168	494	Jan. 09, 2019	Jan. 08, 2021
Test software	Tonscend	JS32-RE	N/A	N/A	N/A

7. PEAK OUTPUT POWER

7.1. MEASUREMENT PROCEDURE

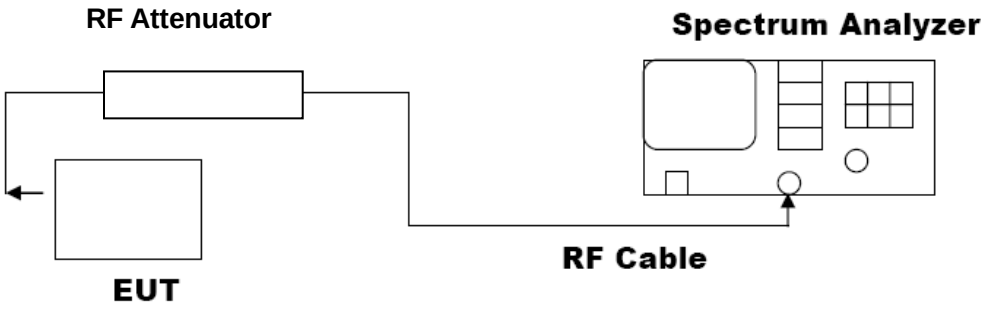
For peak power test:

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. RBW≥DTS bandwidth
3. VBW≥3*RBW.
4. SPAN≥VBW.
5. Sweep: Auto.
6. Detector function: Peak.
7. Trace: Max hold.

Allow trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power, after any corrections for external attenuators and cables.

7.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

PEAK POWER TEST SETUP

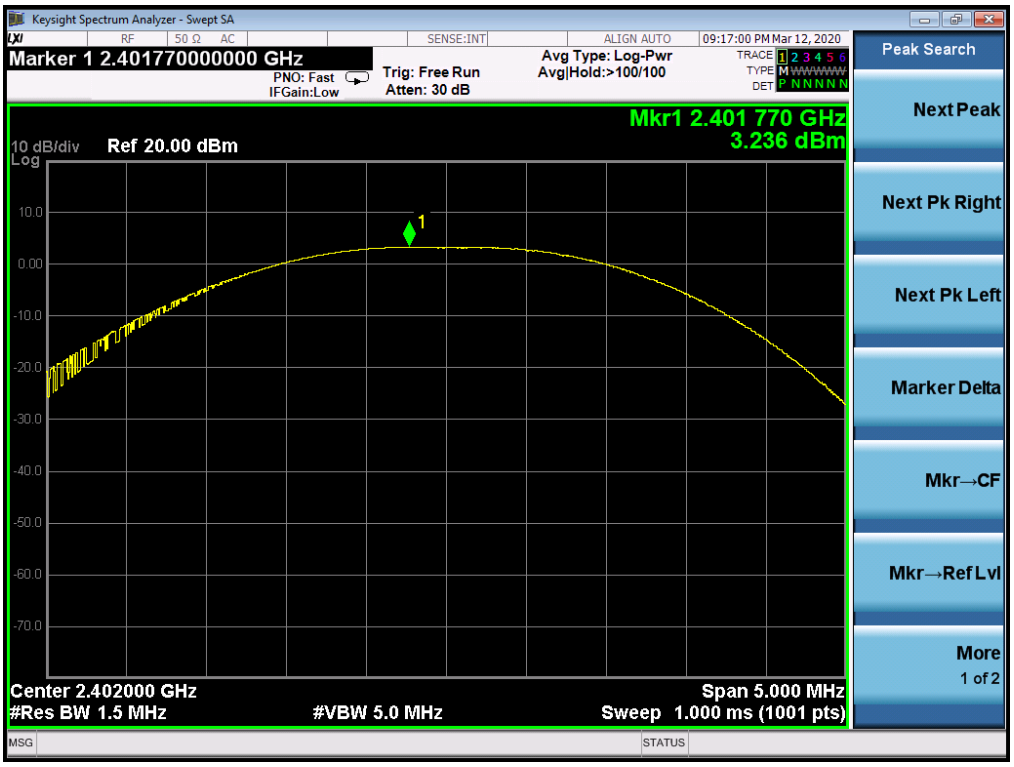


7.3. LIMITS AND MEASUREMENT RESULT

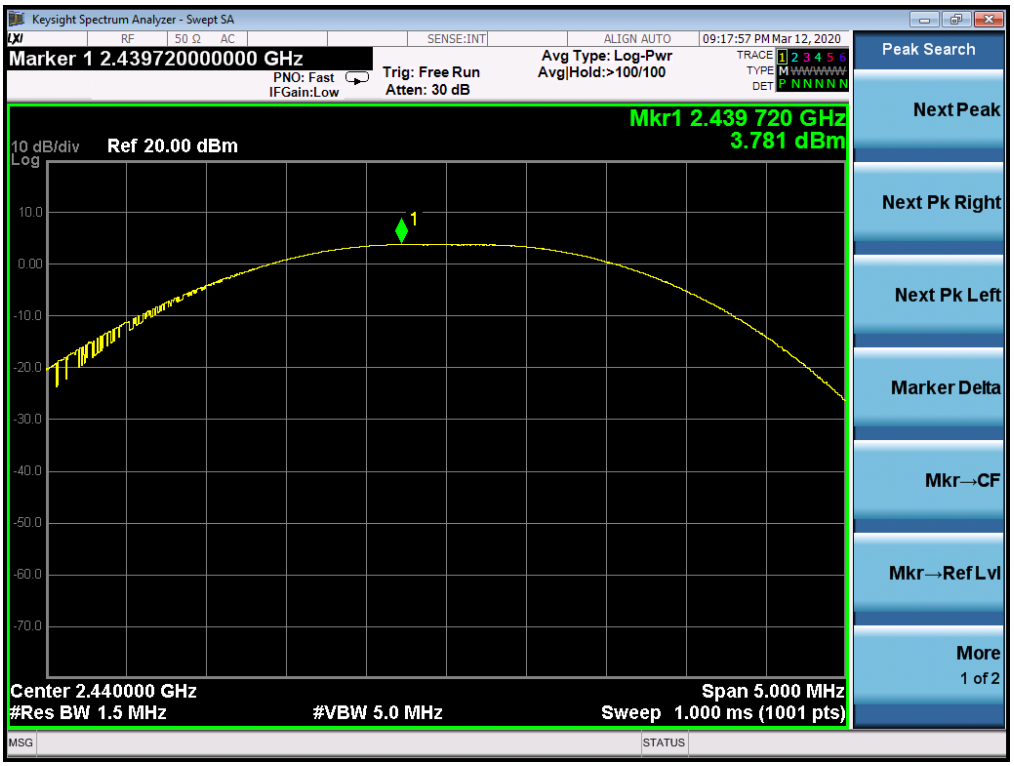
1M

PEAK OUTPUT POWER MEASUREMENT RESULT FOR GFSK MOUDULATION			
Frequency (GHz)	**Peak Power (dBm)**	**Applicable Limits (dBm)**	**Pass or Fail**
2.402	3.236	30	Pass
2.440	3.781	30	Pass
2.480	3.725	30	Pass

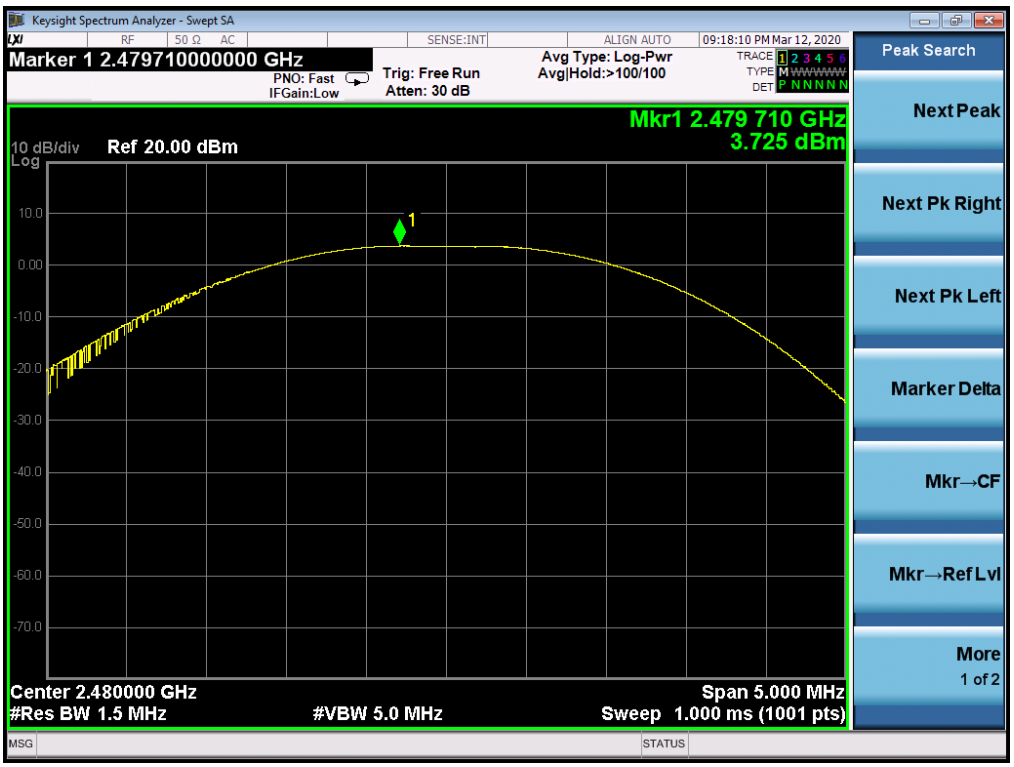
CH0



CH19


Keysight Spectrum Analyzer - Swept SA
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
09:17:57 PM Mar 12, 2020
Marker 1 2.439720000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Mkr1 2.439 720 GHz
3.781 dBm
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.440000 GHz
#Res BW 1.5 MHz
#VBW 5.0 MHz
Span 5.000 MHz
Sweep 1.000 ms (1001 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

CH39

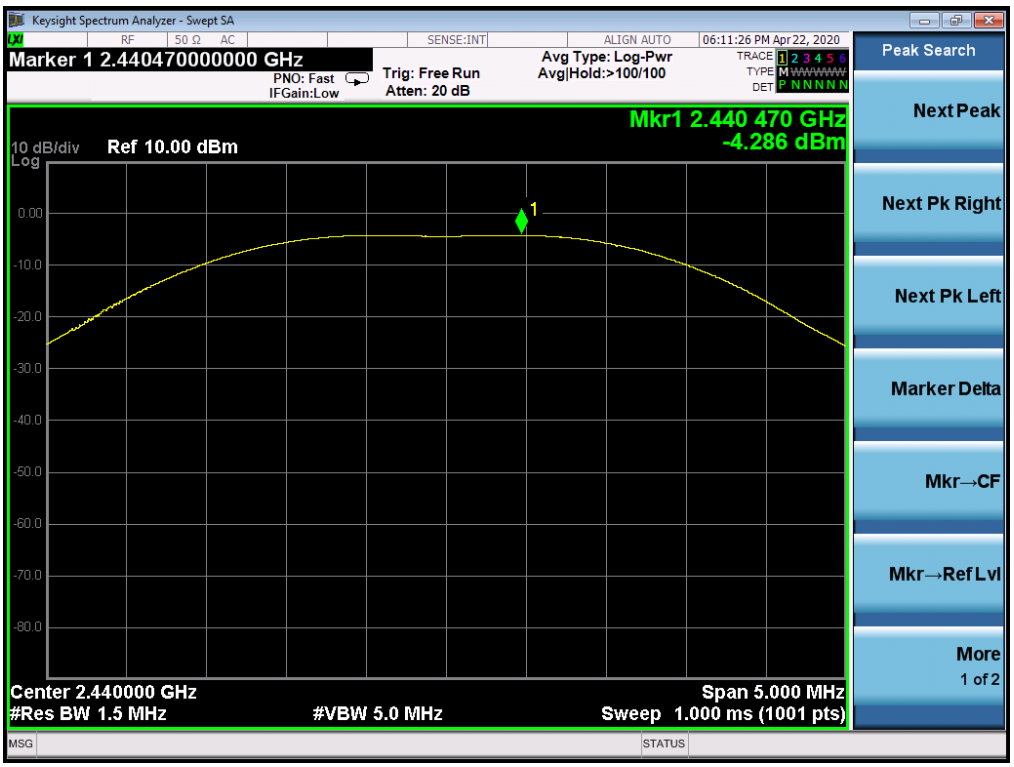

Keysight Spectrum Analyzer - Swept SA
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
09:18:10 PM Mar 12, 2020
Marker 1 2.479710000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Mkr1 2.479 710 GHz
3.725 dBm
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.480000 GHz
#Res BW 1.5 MHz
#VBW 5.0 MHz
Span 5.000 MHz
Sweep 1.000 ms (1001 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

2M

PEAK OUTPUT POWER MEASUREMENT RESULT FOR GFSK MOUDULATION			
Frequency (GHz)	**Peak Power (dBm)**	**Applicable Limits (dBm)**	**Pass or Fail**
2.402	-4.979	30	Pass
2.440	-4.286	30	Pass
2.480	-5.502	30	Pass

CH0

CH19


Keysight Spectrum Analyzer - Swept SA
RF 50 Ω AC
SENSE:INT
ALIGN AUTO
06:11:26 PM Apr 22, 2020
Marker 1 2.440470000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Mkr1 2.440 470 GHz
-4.286 dBm
10 dB/div
Log
Ref 10.00 dBm
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
Center 2.440000 GHz
#Res BW 1.5 MHz
#VBW 5.0 MHz
Span 5.000 MHz
Sweep 1.000 ms (1001 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

CH39


Keysight Spectrum Analyzer - Swept SA
RF 50 Ω AC
SENSE:INT
ALIGN AUTO
06:11:36 PM Apr 22, 2020
Marker 1 2.479490000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Mkr1 2.479 490 GHz
-5.502 dBm
10 dB/div
Log
Ref 10.00 dBm
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
Center 2.480000 GHz
#Res BW 1.5 MHz
#VBW 5.0 MHz
Span 5.000 MHz
Sweep 1.000 ms (1001 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

8. 6 DB BANDWIDTH

8.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set SPA Centre Frequency = Operation Frequency, RBW= 100 KHz, VBW≥3×RBW.
4. Set SPA Trace 1 Max hold, then View.

Note: The EUT was tested according to ANSI C63.10 for compliance to RSS-247 requirements.

8.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

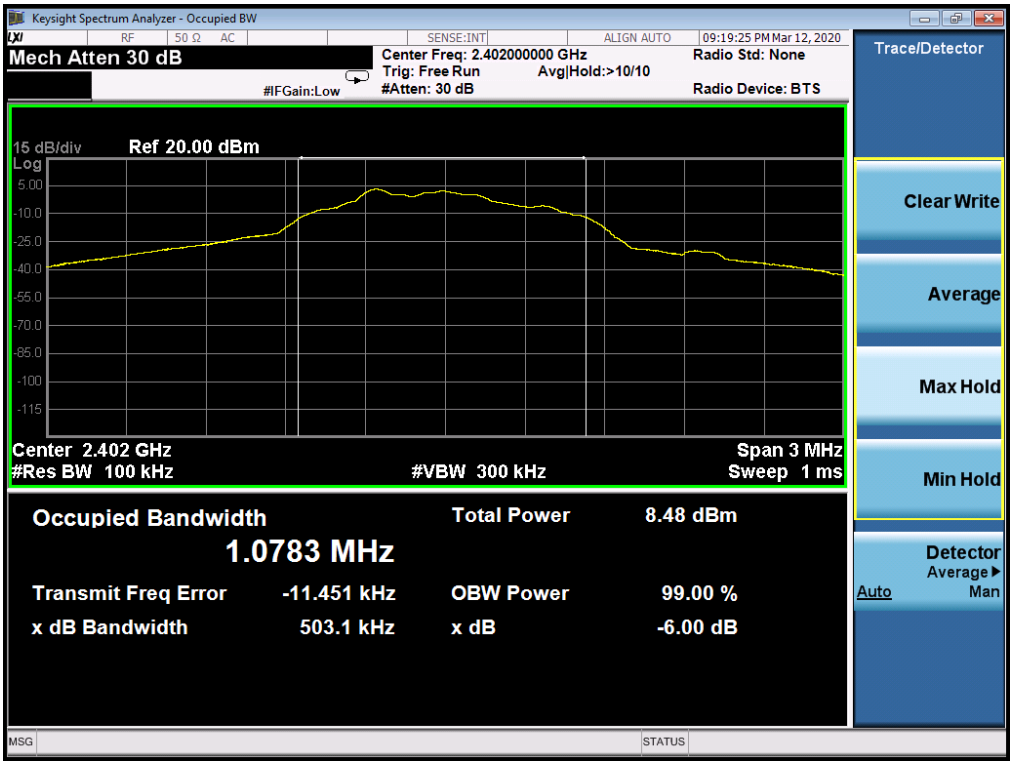
The same as described in section 7.2.

8.3. LIMITS AND MEASUREMENT RESULTS

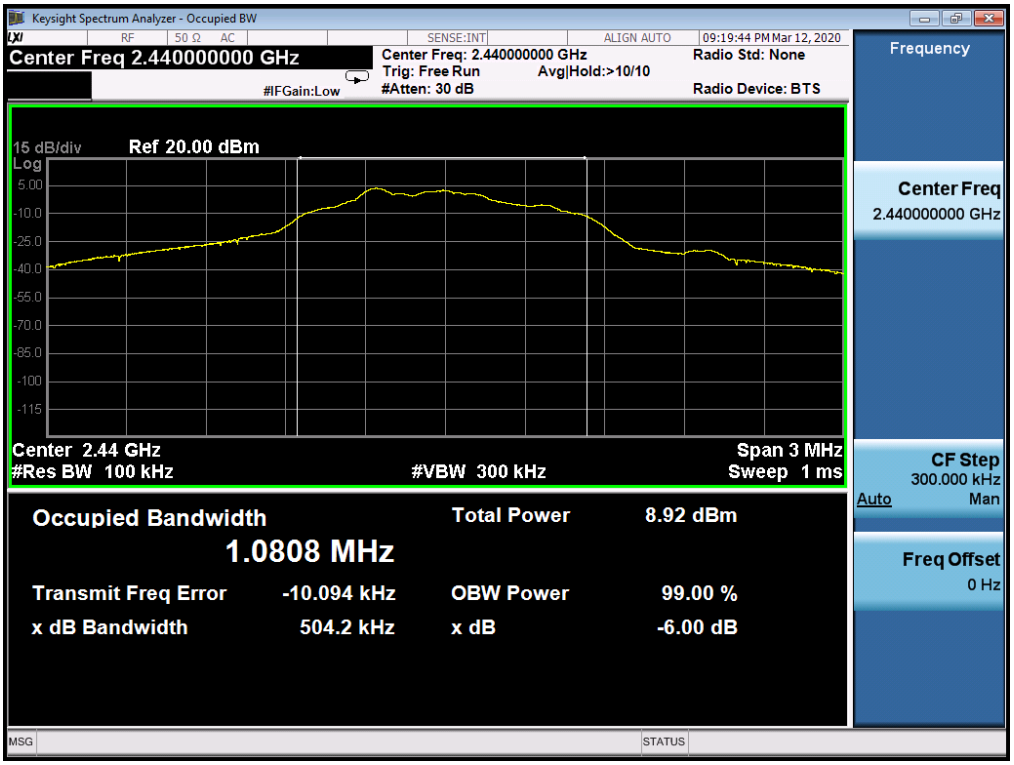
1M

LIMITS AND MEASUREMENT RESULT			
Applicable Limits	**Applicable Limits**		
	Test Data (KHz)		**Criteria**
>500KHz	Low Channel	503.1	PASS
	Middle Channel	504.2	PASS
	High Channel	502.8	PASS

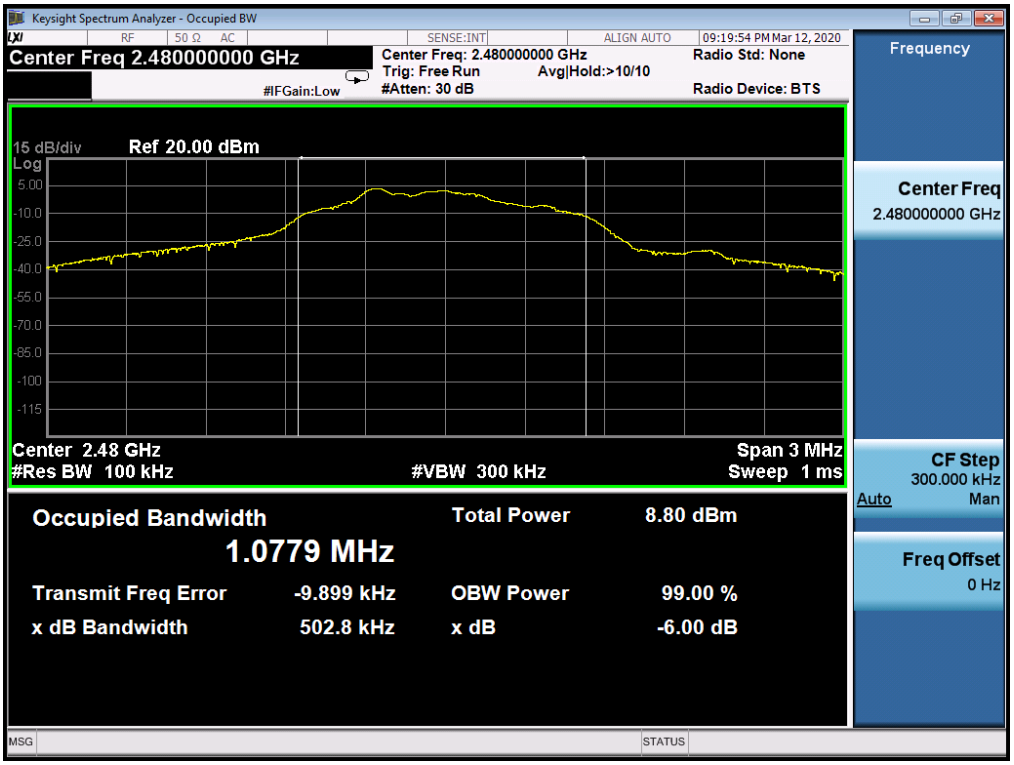
TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



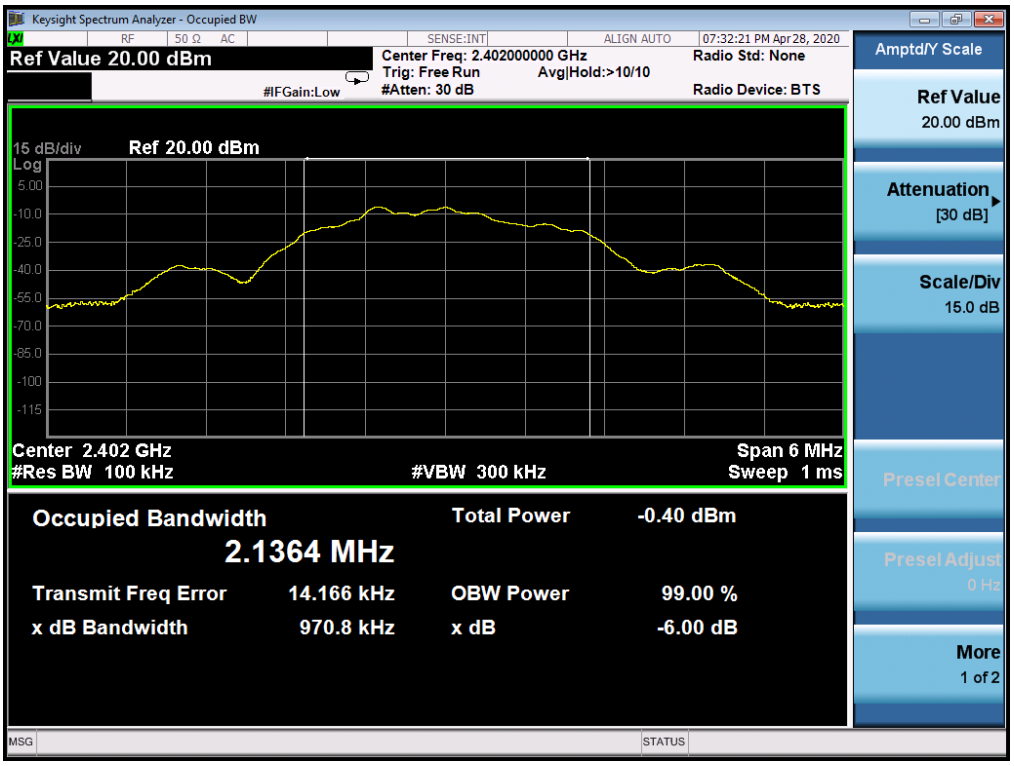
TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



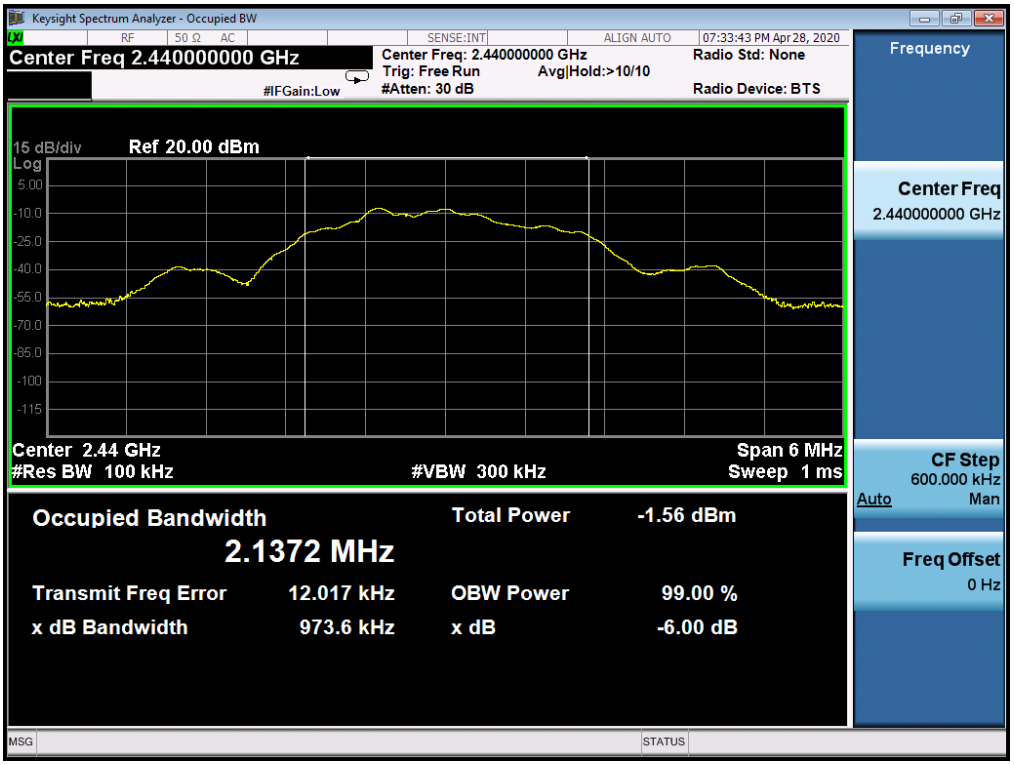
2M

LIMITS AND MEASUREMENT RESULT			
Applicable Limits	**Applicable Limits**		
	Test Data (KHz)		**Criteria**
>500KHz	Low Channel	970.8	PASS
	Middle Channel	973.6	PASS
	High Channel	972.4	PASS

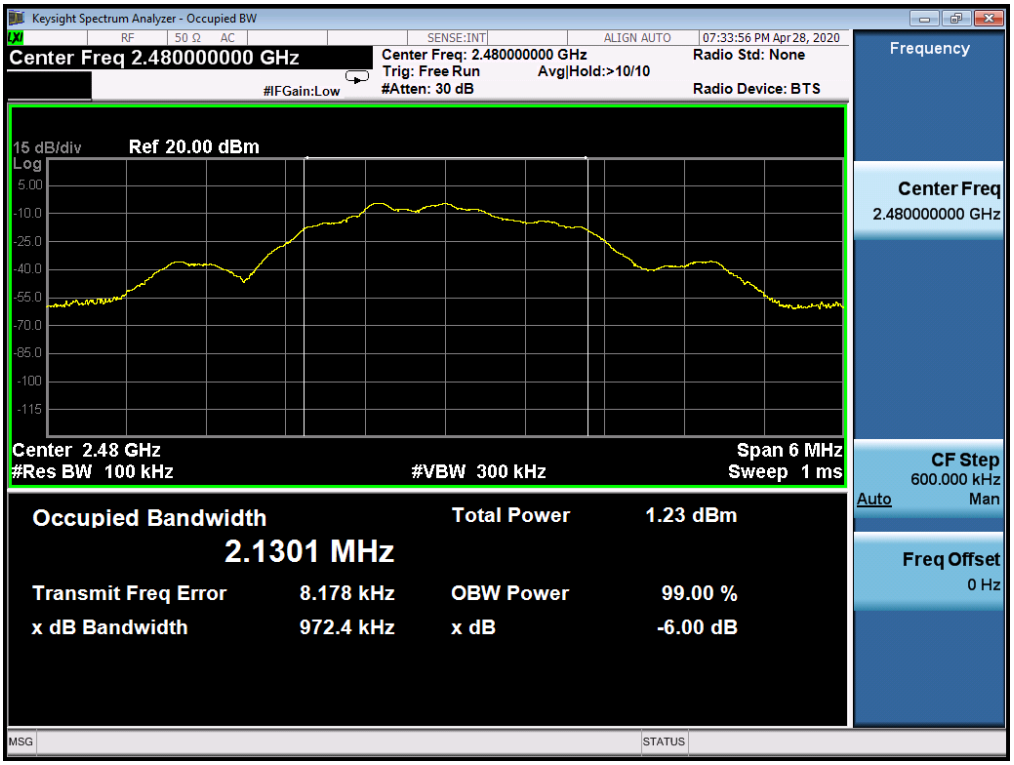
TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



9. CONDUCTED SPURIOUS EMISSION

9.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2, Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set SPA Trace 1 Max hold, then View.

Note: The EUT was tested according to ANSI C63.10 for compliance to RSS-247 requirements.

9.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

The same as described in section 7.2.

9.3. MEASUREMENT EQUIPMENT USED

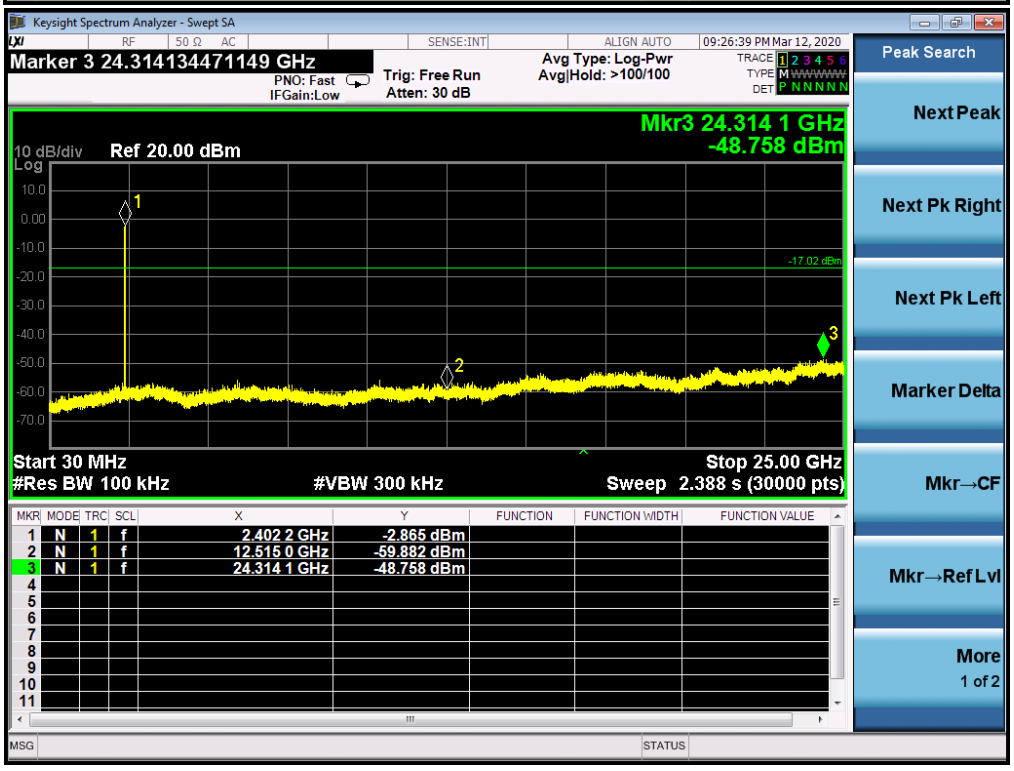
The same as described in section 6.

9.4. LIMITS AND MEASUREMENT RESULT

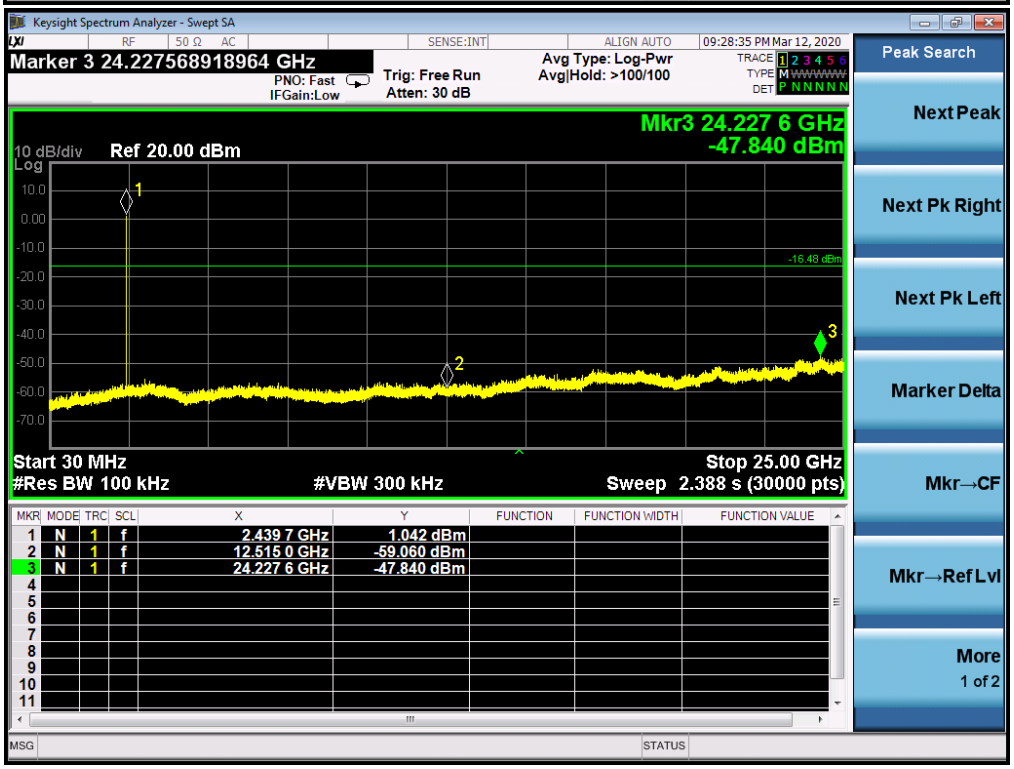
LIMITS AND MEASUREMENT RESULT		
Applicable Limits	**Measurement Result**	
	Test Data	**Criteria**
In any 100 KHz Bandwidth Outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produce by the intentional radiator shall be at least 20 dB below that in 100KHz bandwidth within the band that contains the highest level of the desired power.	At least -20dBc than the reference level	PASS

TEST RESULT FOR ENTIRE FREQUENCY RANGE-1M

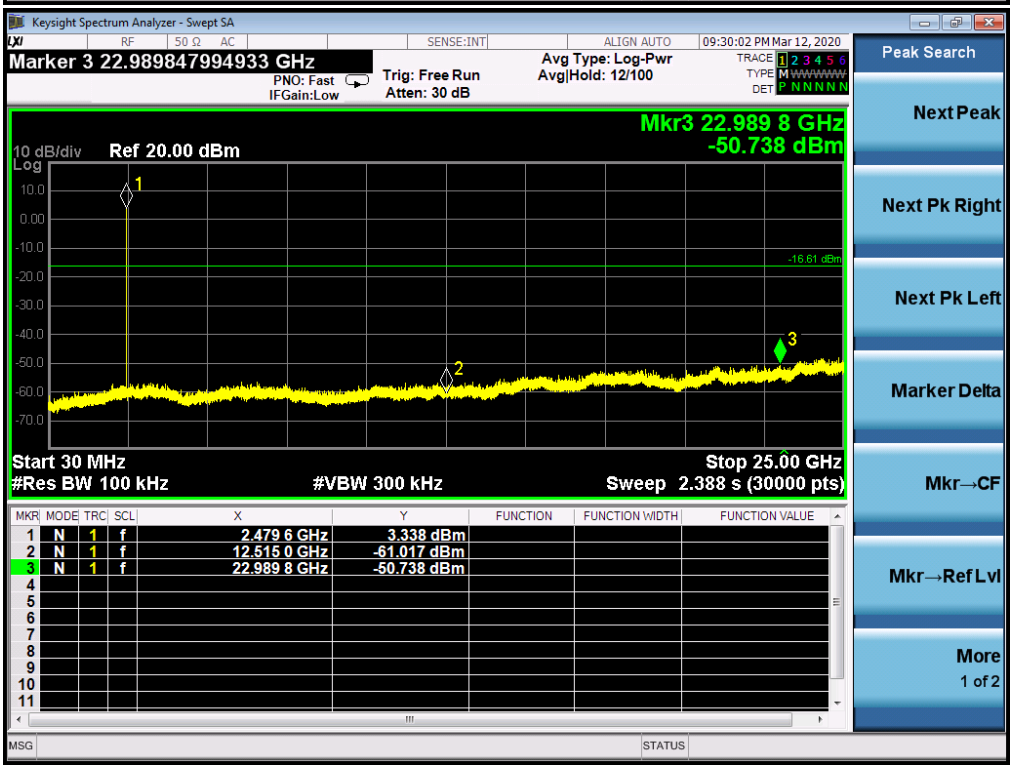
GFSK MODULATION IN LOW CHANNEL



GFSK MODULATION IN MIDDLE CHANNEL

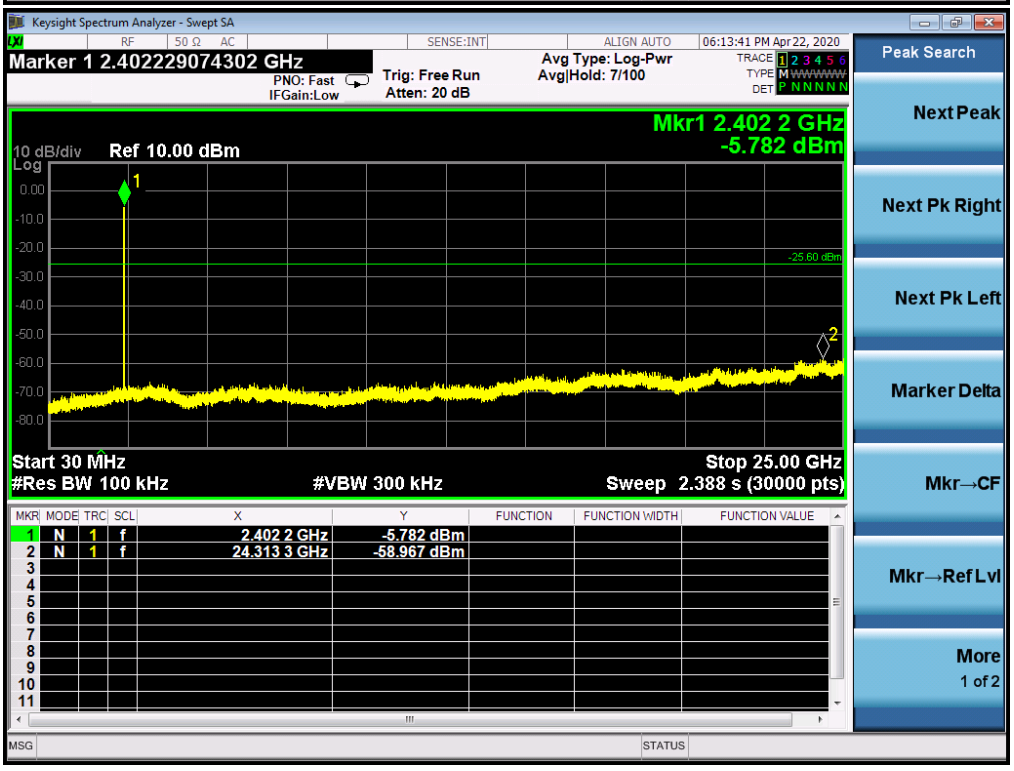


GFSK MODULATION IN HIGH CHANNEL

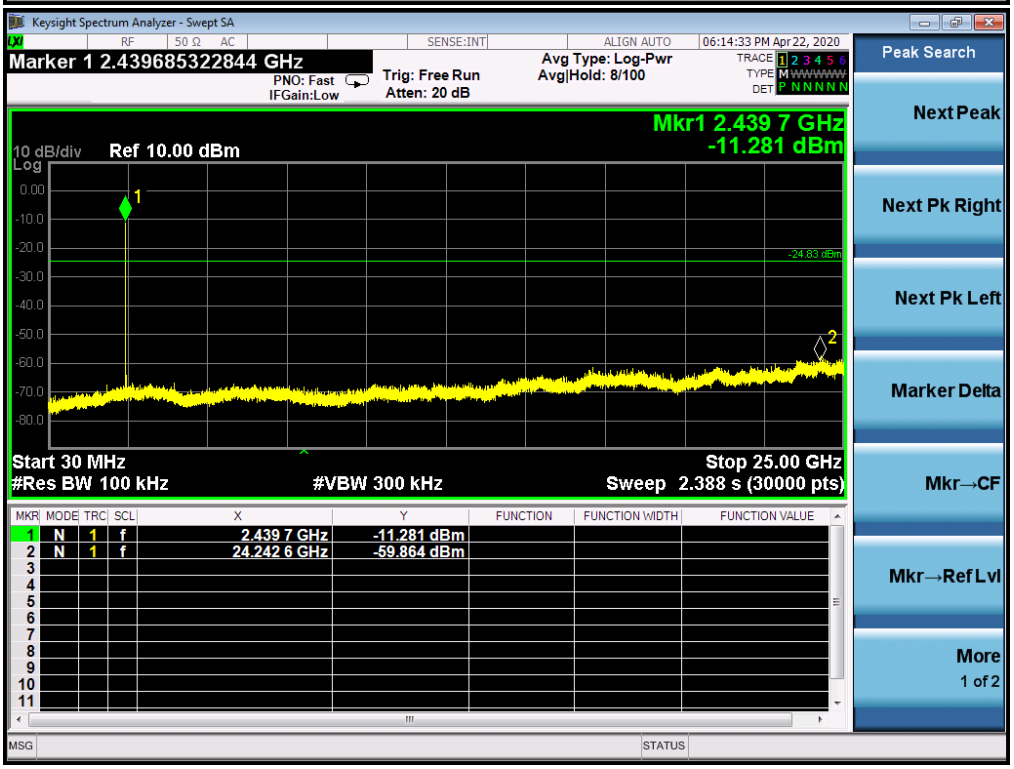


TEST RESULT FOR ENTIRE FREQUENCY RANGE-2M

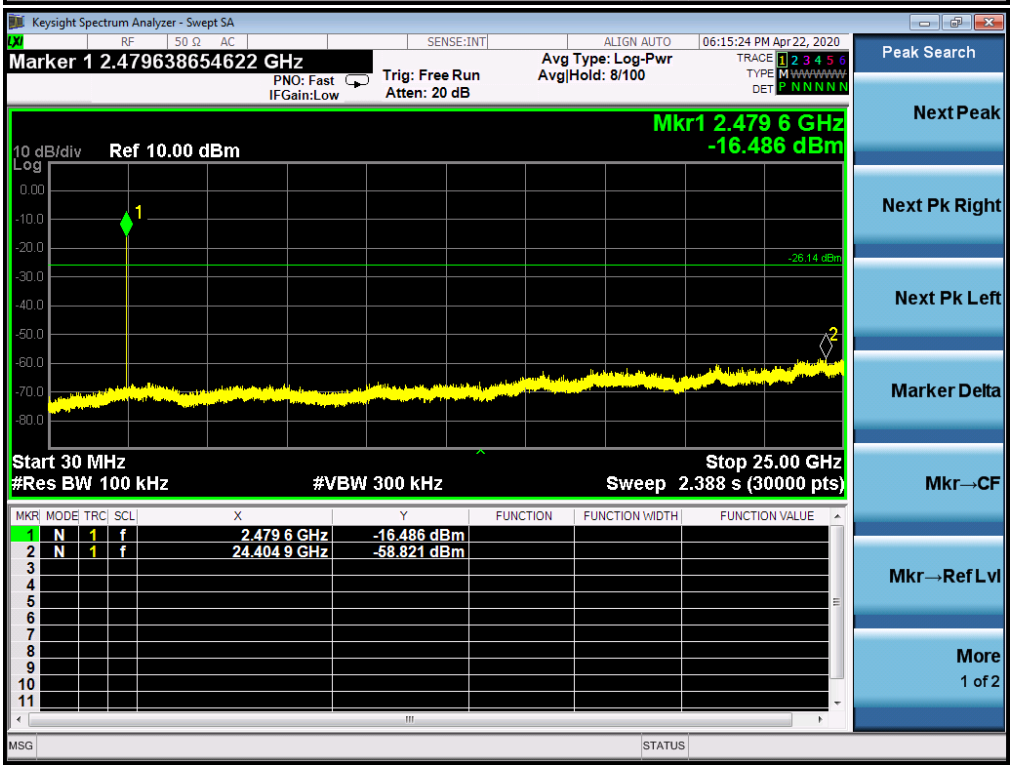
GFSK MODULATION IN LOW CHANNEL



GFSK MODULATION IN MIDDLE CHANNEL



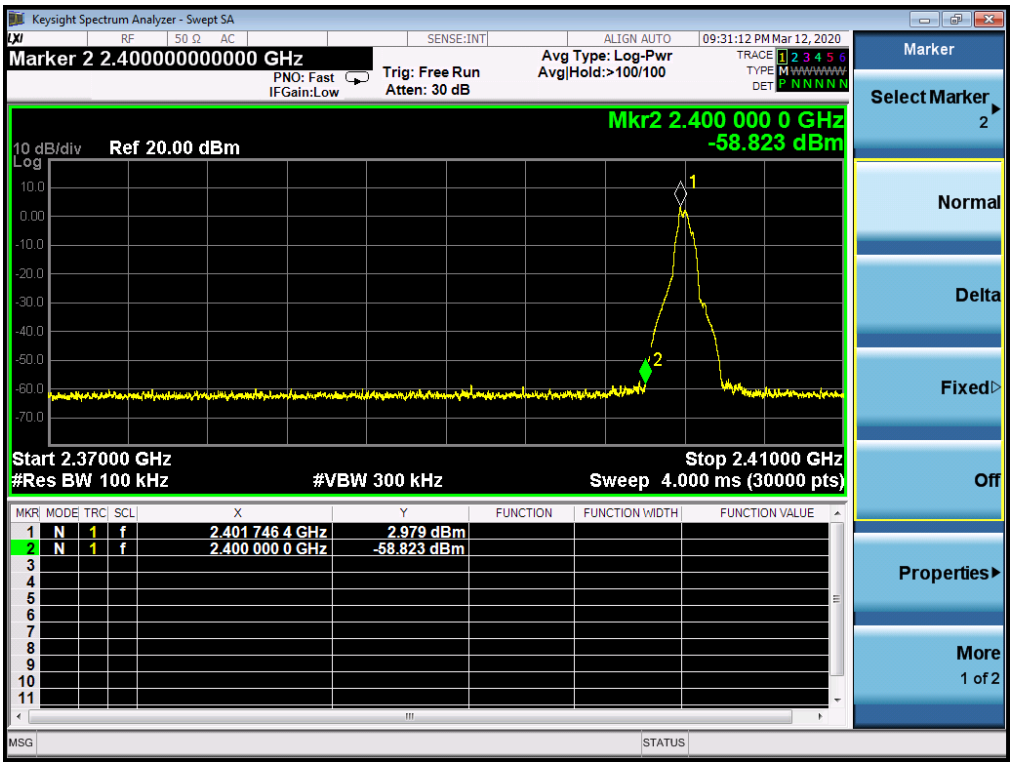
GFSK MODULATION IN HIGH CHANNEL



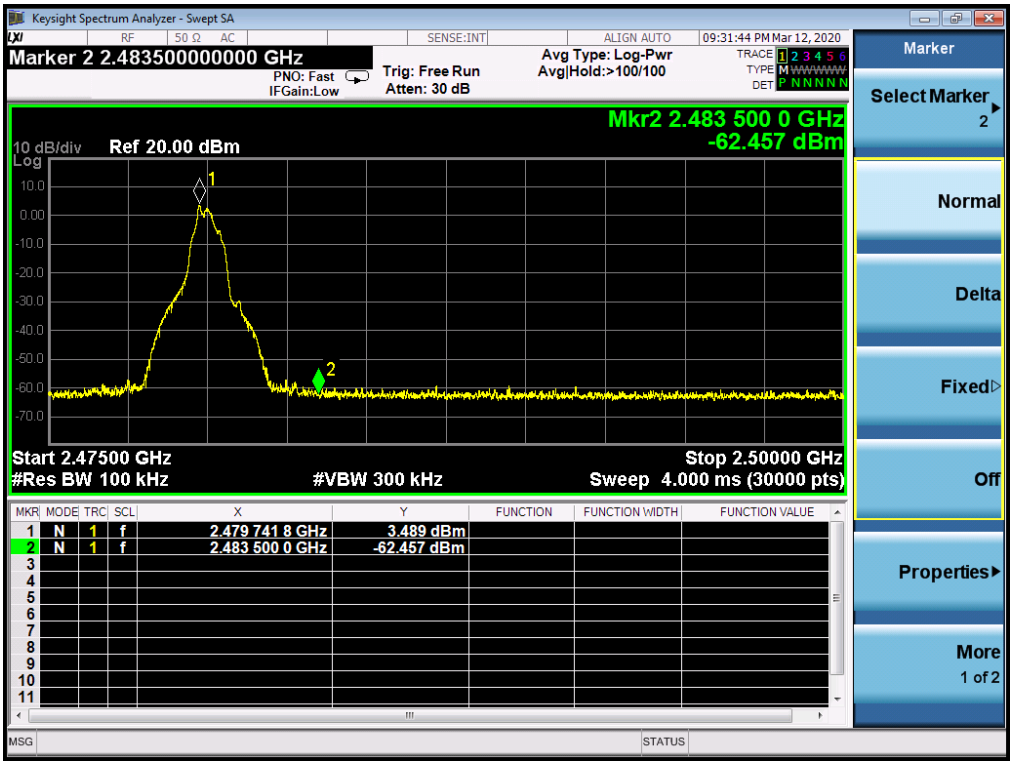
Note: The peak emissions without marker on the above plots are fundamental wave and need not to compare with the limit.

TEST RESULT FOR BAND EDGE-1M

GFSK MODULATION IN LOW CHANNEL

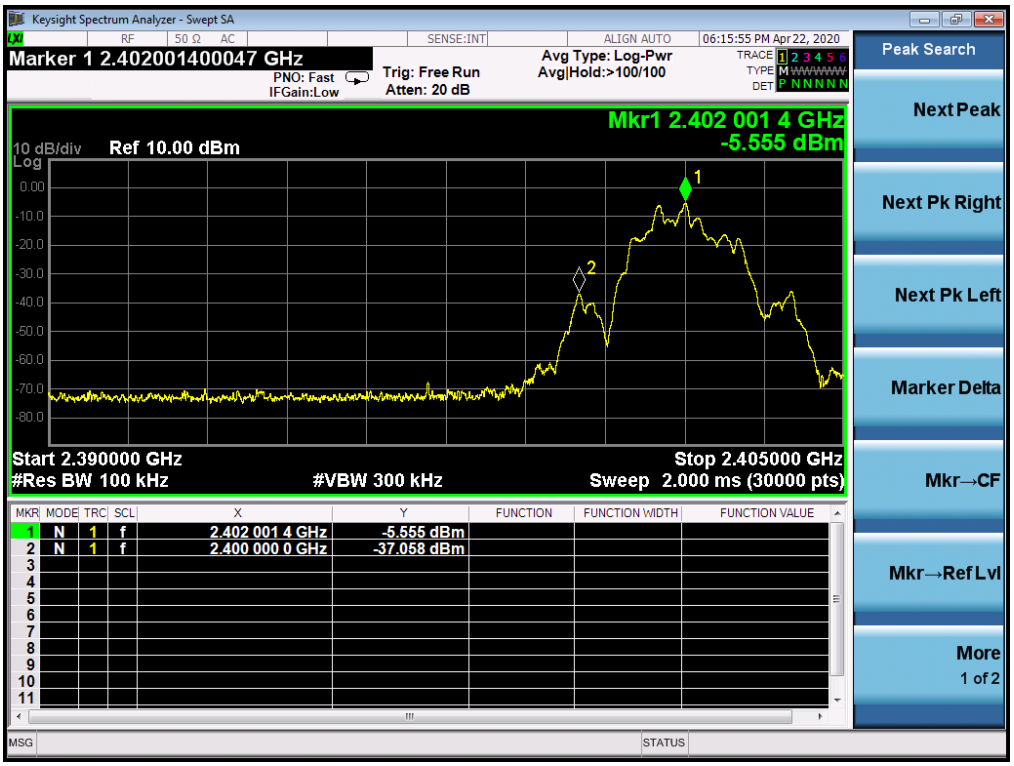


GFSK MODULATION IN HIGH CHANNEL

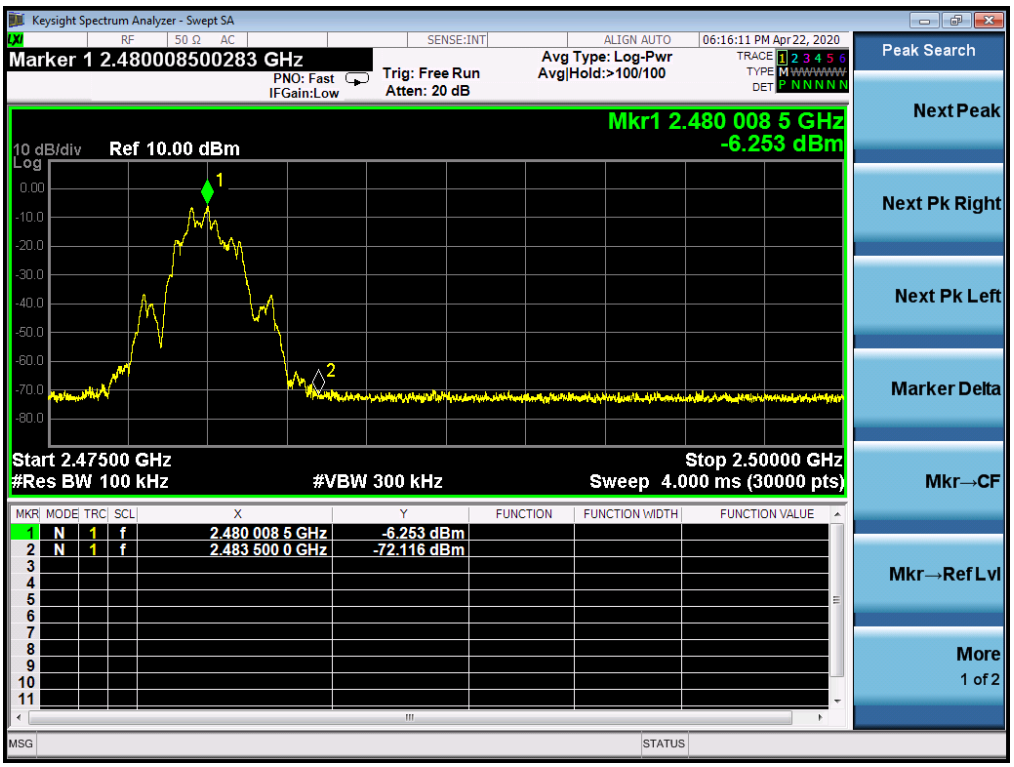


TEST RESULT FOR BAND EDGE-2M

GFSK MODULATION IN LOW CHANNEL



GFSK MODULATION IN HIGH CHANNEL



10. MAXIMUM CONDUCTED OUTPUT POWER SPECTRAL DENSITY

10.1 MEASUREMENT PROCEDURE

(1). Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator

(2). Set the EUT Work on the top, the middle and the bottom operation frequency individually.

(3). Set SPA Trace 1 Max hold, then View.

Note: The method of PKPSD in the KDB 558074 item 10.2 was used in this testing.

10.2 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

Refer To Section 7.2.

10.3 MEASUREMENT EQUIPMENT USED

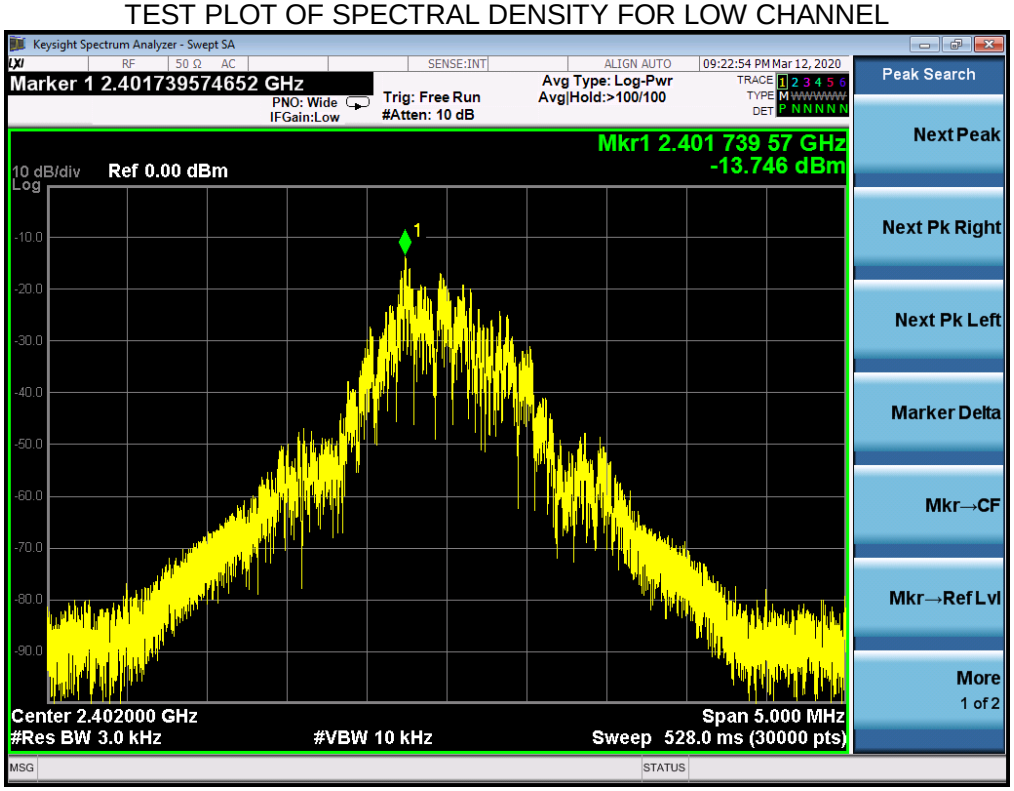
Refer To Section 6.

10.4 LIMITS AND MEASUREMENT RESULT

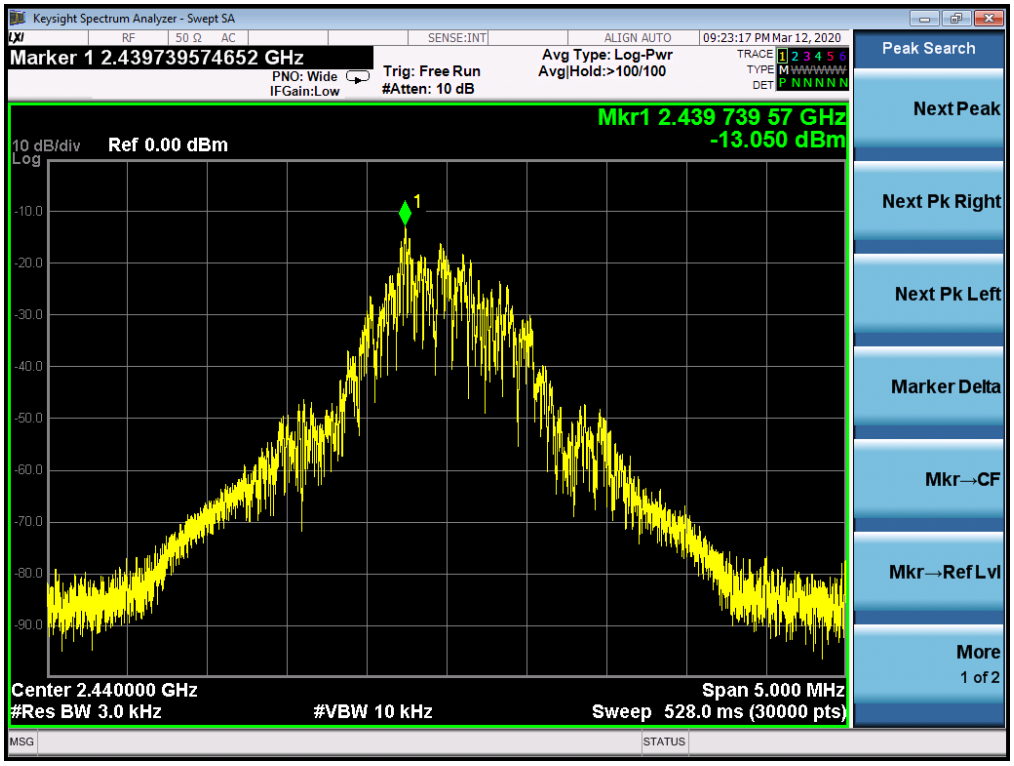
1M

Channel No.	PSD (dBm/3KHz)	Limit (dBm/3KHz)	Result
Low Channel	-13.746	8	Pass
Middle Channel	-13.050	8	Pass
High Channel	-13.240	8	Pass

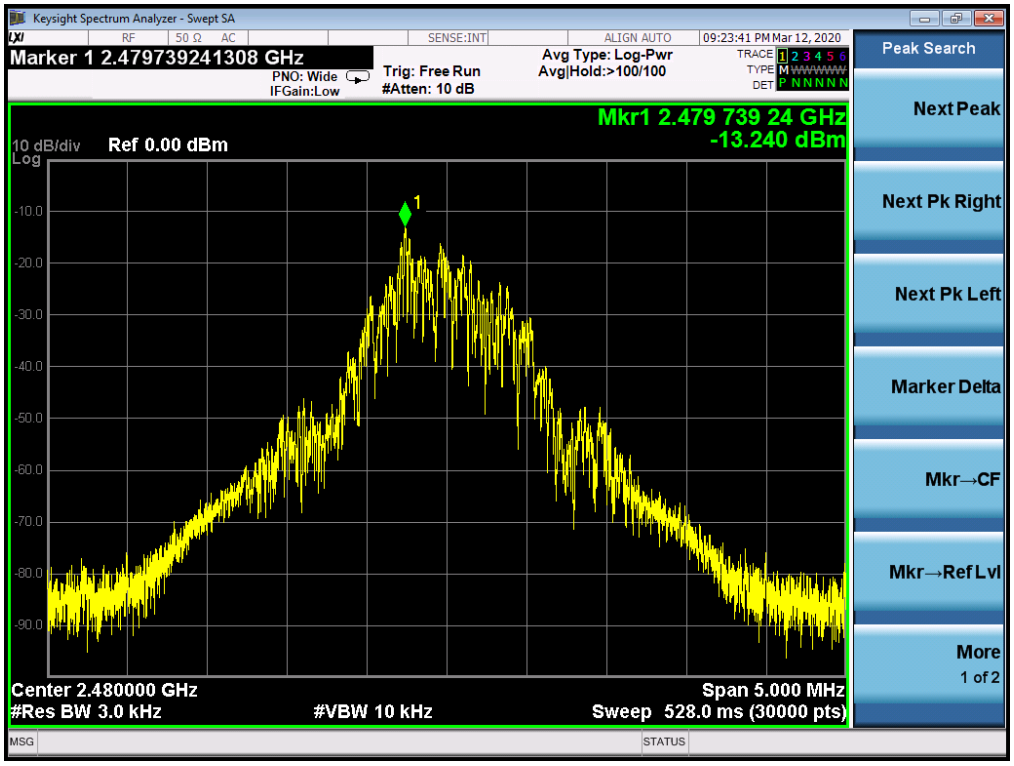
TEST PLOT OF SPECTRAL DENSITY FOR LOW CHANNEL



TEST PLOT OF SPECTRAL DENSITY FOR MIDDLE CHANNEL



TEST PLOT OF SPECTRAL DENSITY FOR HIGH CHANNEL



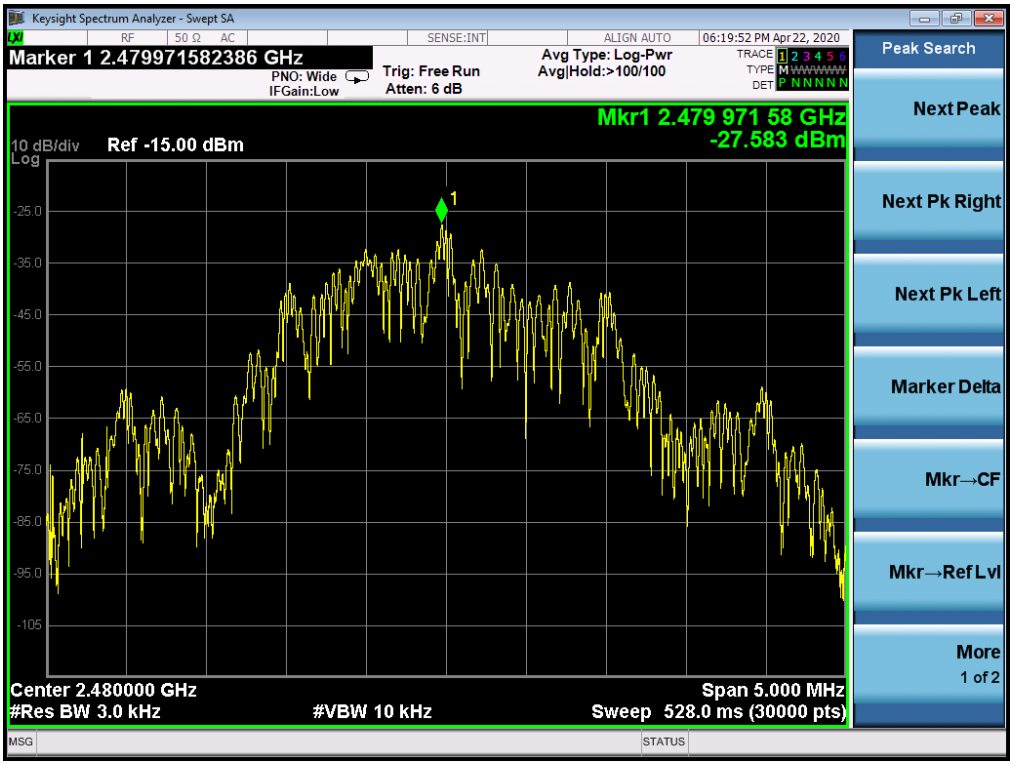
2M

Channel No.	PSD (dBm/3KHz)	Limit (dBm/3KHz)	Result
Low Channel	-26.996	8	Pass
Middle Channel	-26.563	8	Pass
High Channel	-27.583	8	Pass

TEST PLOT OF SPECTRAL DENSITY FOR LOW CHANNEL

TEST PLOT OF SPECTRAL DENSITY FOR MIDDLE CHANNEL

TEST PLOT OF SPECTRAL DENSITY FOR HIGH CHANNEL



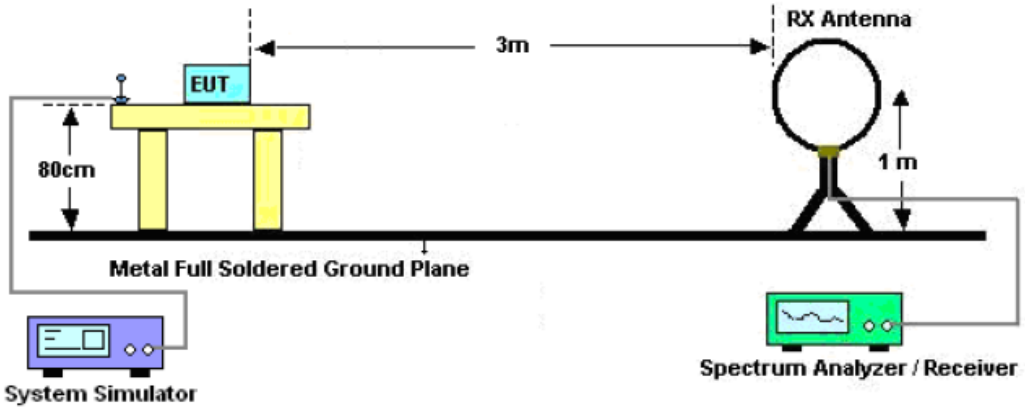
11. RADIATED EMISSION

11.1. MEASUREMENT PROCEDURE

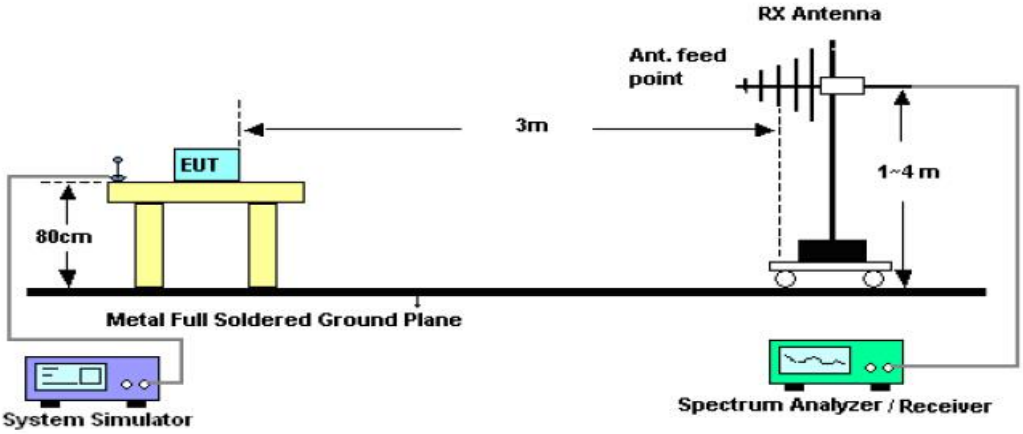
1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz RBW and 3MHz VBW for peak reading. 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.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

11.2. TEST SETUP

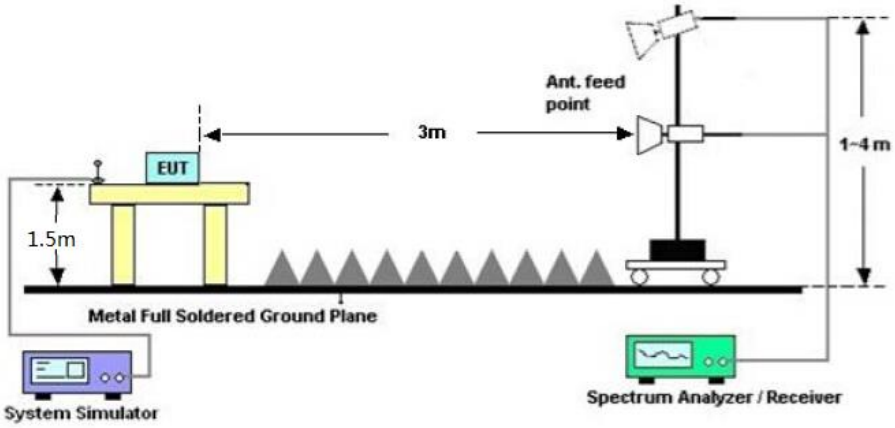
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



11.3. LIMITS AND MEASUREMENT RESULT

15.209 Limit in the below table has to be followed

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Note: All modes were tested For restricted band radiated emission,
the test records reported below are the worst result compared to other modes.

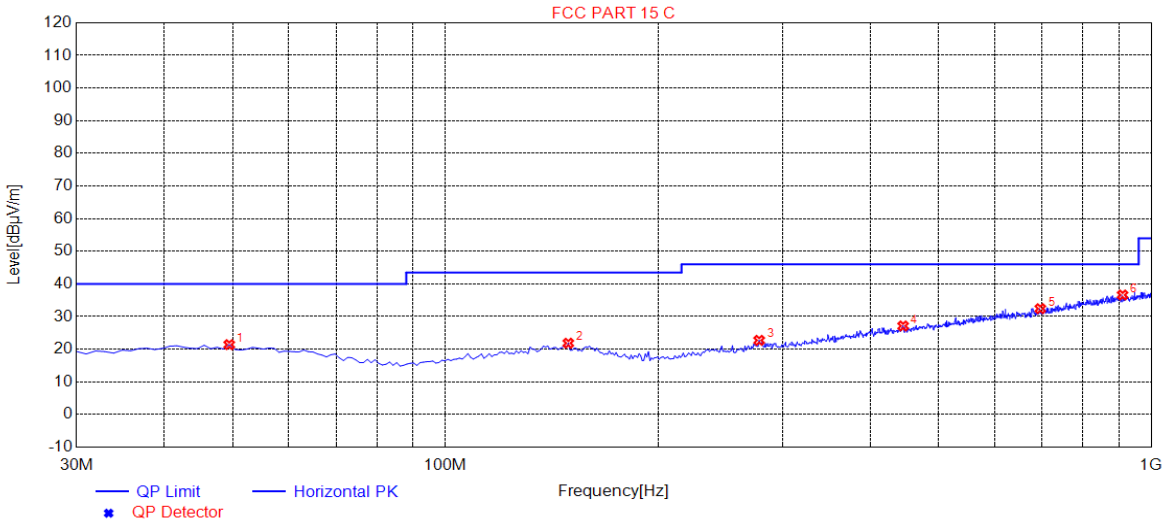
11.4. TEST RESULT

RADIATED EMISSION BELOW 30MHz

No emission found between lowest internal used/generated frequencies to 30MHz.

RADIATED EMISSION BELOW 1GHZ

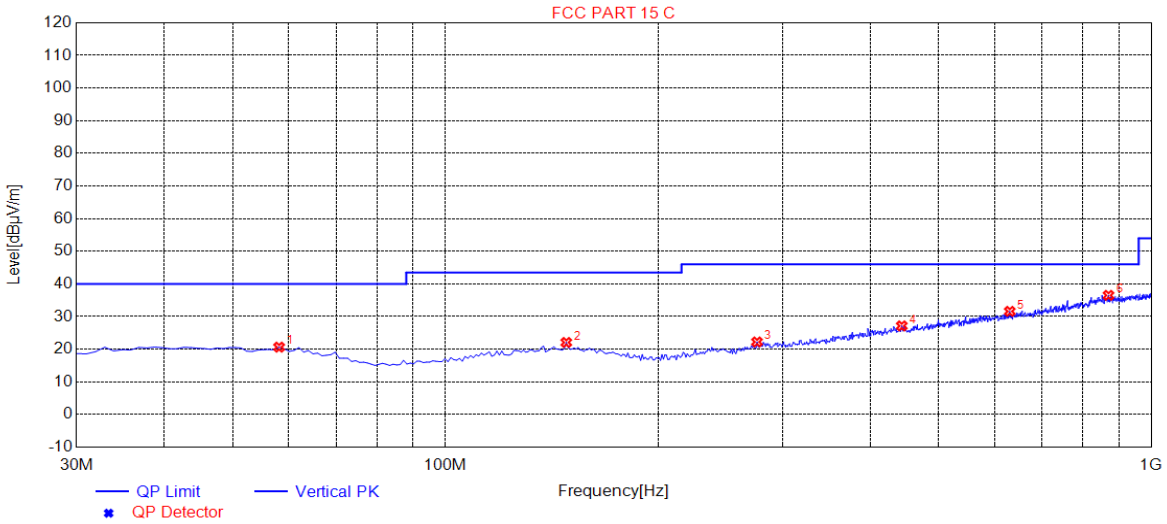
EUT	Open-Source Sensor Beacon	Model Name	RUUVITAG
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Horizontal



NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	49.4000	21.41	14.69	40.00	18.59	150	210	Horizontal
2	149.3100	21.86	14.88	43.50	21.64	150	306	Horizontal
3	278.3200	22.73	16.14	46.00	23.27	150	139	Horizontal
4	445.1600	27.14	20.89	46.00	18.86	150	138	Horizontal
5	696.3900	32.43	25.91	46.00	13.57	150	153	Horizontal
6	910.7600	36.62	30.19	46.00	9.38	150	354	Horizontal

RESULT: PASS

EUT	Open-Source Sensor Beacon	Model Name	RUUVITAG
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical



NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	58.1300	20.65	14.05	40.00	19.35	150	90	Vertical
2	148.3400	22.09	14.88	43.50	21.41	150	192	Vertical
3	276.3800	22.24	15.96	46.00	23.76	150	54	Vertical
4	443.2200	27.15	20.84	46.00	18.85	150	358	Vertical
5	630.4300	31.61	24.85	46.00	14.39	150	342	Vertical
6	870.0200	36.51	29.60	46.00	9.49	150	71	Vertical

RESULT: PASS
Note:
1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.
2. All test modes had been tested. The mode 1 is the worst case and recorded in the report.

RADIATED EMISSION ABOVE 1GHZ

EUT	Open-Source Sensor Beacon	**Model Name**	RUUVITAG
Temperature	25° C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 1	**Antenna**	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4804.011	46.25	0.08	46.33	74	-27.67	peak
4804.011	41.37	0.08	41.45	54	-12.55	AVG
7206.022	42.89	2.21	45.1	74	-28.9	peak
7206.022	36.13	2.21	38.34	54	-15.66	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	Open-Source Sensor Beacon	**Model Name**	RUUVITAG
Temperature	25° C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 1	**Antenna**	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4804.011	43.58	0.08	43.66	74	-30.34	peak
4804.011	40.43	0.08	40.51	54	-13.49	AVG
7206.022	41.27	2.21	43.48	74	-30.52	peak
7206.022	36.18	2.21	38.39	54	-15.61	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	Open-Source Sensor Beacon	Model Name	RUUVITAG
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 2	Antenna	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4880.005	44.96	0.14	45.1	74	-28.9	peak
4880.005	40.05	0.14	40.19	54	-13.81	AVG
7320.140	43.58	2.36	45.94	74	-28.06	peak
7320.140	37.27	2.36	39.63	54	-14.37	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	Open-Source Sensor Beacon	Model Name	RUUVITAG
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 2	Antenna	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4880.050	43.53	0.14	43.67	74	-30.33	peak
4880.050	38.74	0.14	38.88	54	-15.12	AVG
7320.080	40.22	2.36	42.58	74	-31.42	peak
7320.080	35.28	2.36	37.64	54	-16.36	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	Open-Source Sensor Beacon	Model Name	RUUVITAG
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4960.012	46.25	0.22	46.47	74	-27.53	peak
4960.012	42.11	0.22	42.33	54	-11.67	AVG
7440.027	43.81	2.64	46.45	74	-27.55	peak
7440.027	38.35	2.64	40.99	54	-13.01	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	Open-Source Sensor Beacon	Model Name	RUUVITAG
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4960.013	44.37	0.22	44.59	74	-29.41	peak
4960.013	40.91	0.22	41.13	54	-12.87	AVG
7440.027	41.37	2.64	44.01	74	-29.99	peak
7440.027	37.28	2.64	39.92	54	-14.08	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

RESULT: PASS

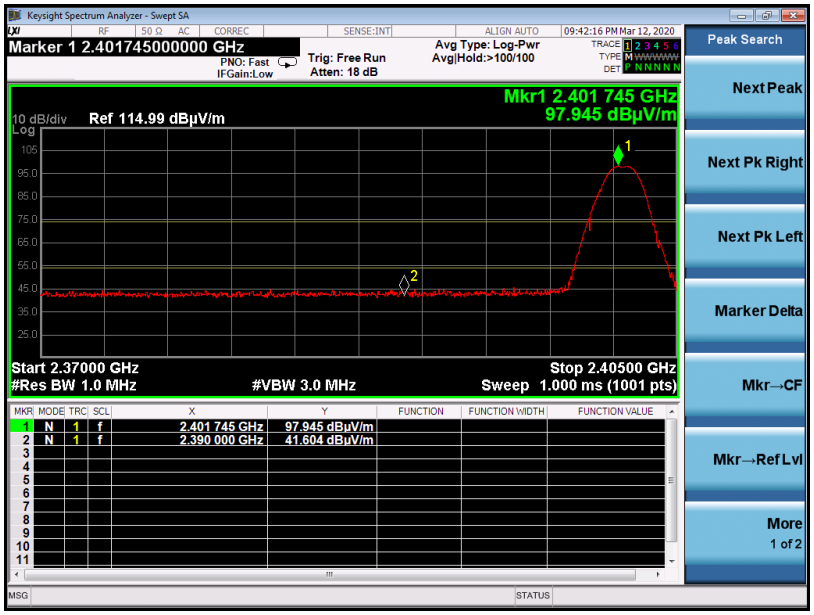
Note:

1. Other emissions from 1G to 25 GHz are considered as ambient noise. No recording in the test report.
2. Factor = Antenna Factor + Cable loss - Amplifier gain, Over=Measure-Limit.
3. The “Factor” value can be calculated automatically by software of measurement system.
4. The report only records the worst test results

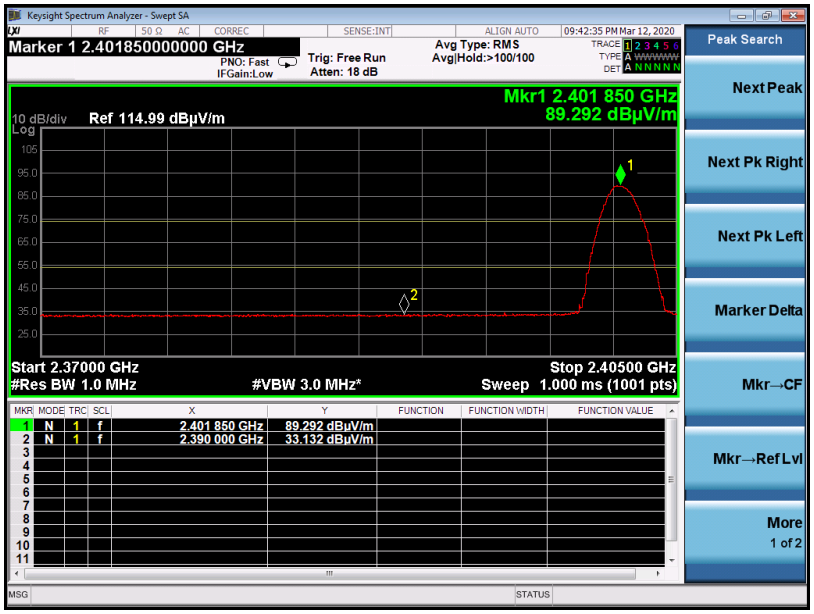
TEST RESULT FOR RESTRICTED BANDS REQUIREMENTS
1M

EUT	Open-Source Sensor Beacon	**Model Name**	RUUVITAG
Temperature	25° C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 1	**Antenna**	Horizontal

PK



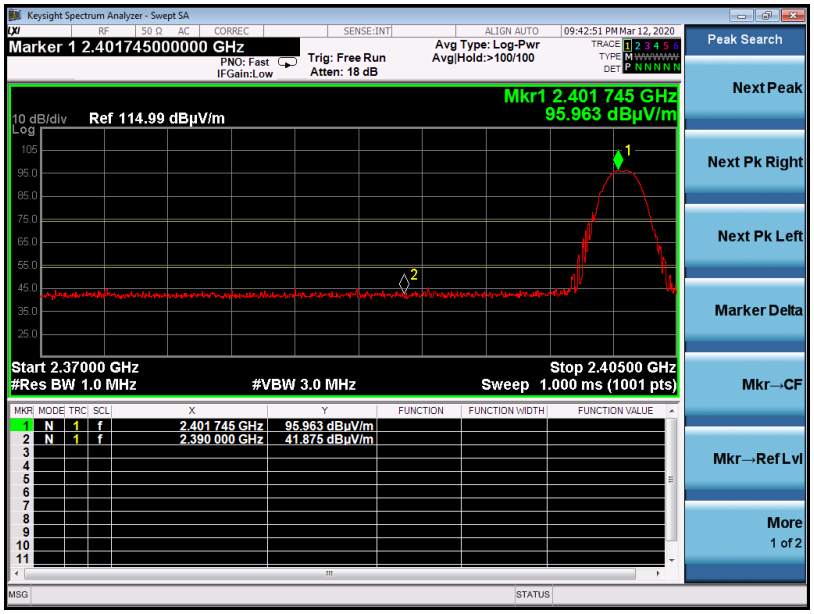
AV



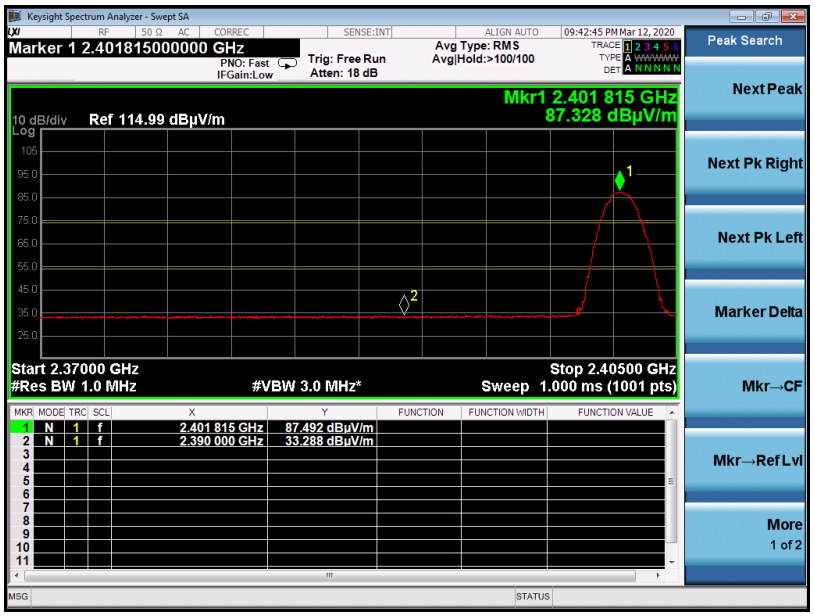
RESULT: PASS

EUT	Open-Source Sensor Beacon	Model Name	RUUVITAG
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical

PK



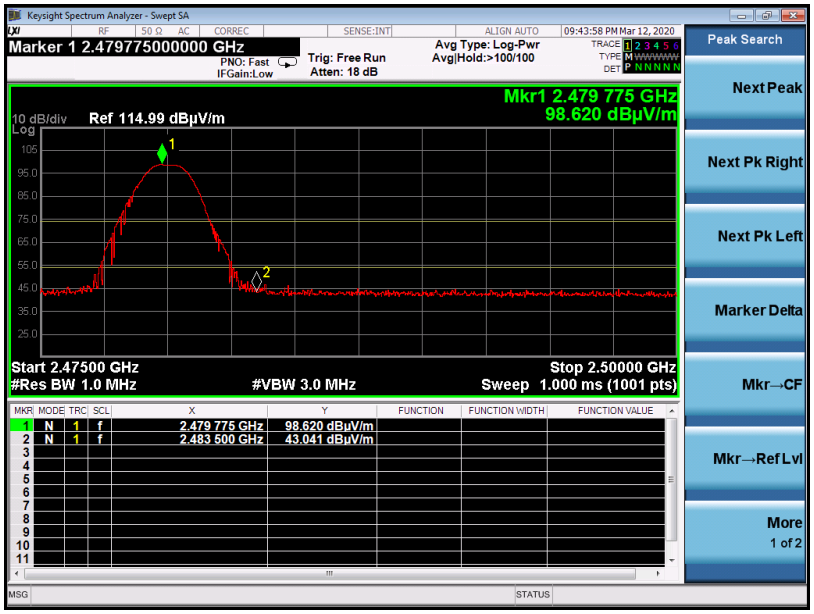
AV



RESULT: PASS

EUT	Open-Source Sensor Beacon	Model Name	RUUVITAG
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Horizontal

PK

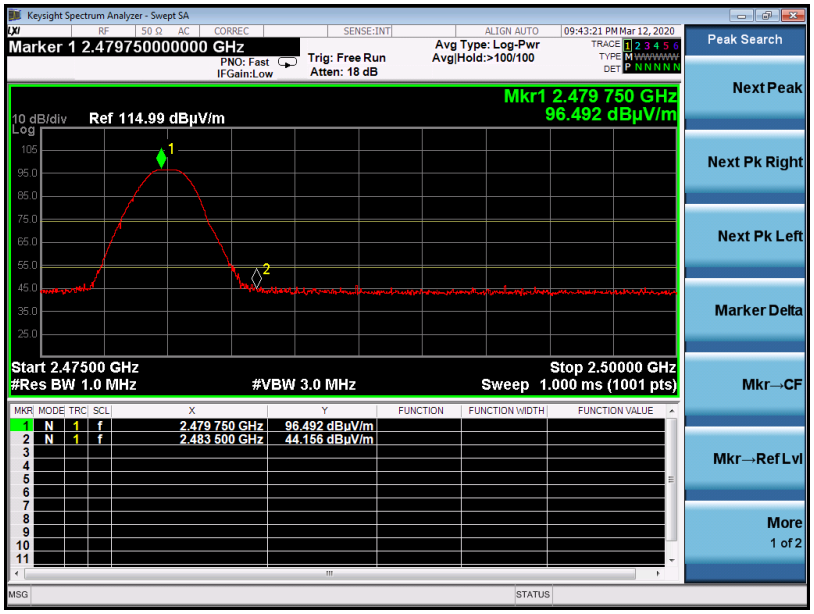


AV

RESULT: PASS

EUT	Open-Source Sensor Beacon	Model Name	RUUVITAG
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Vertical

PK

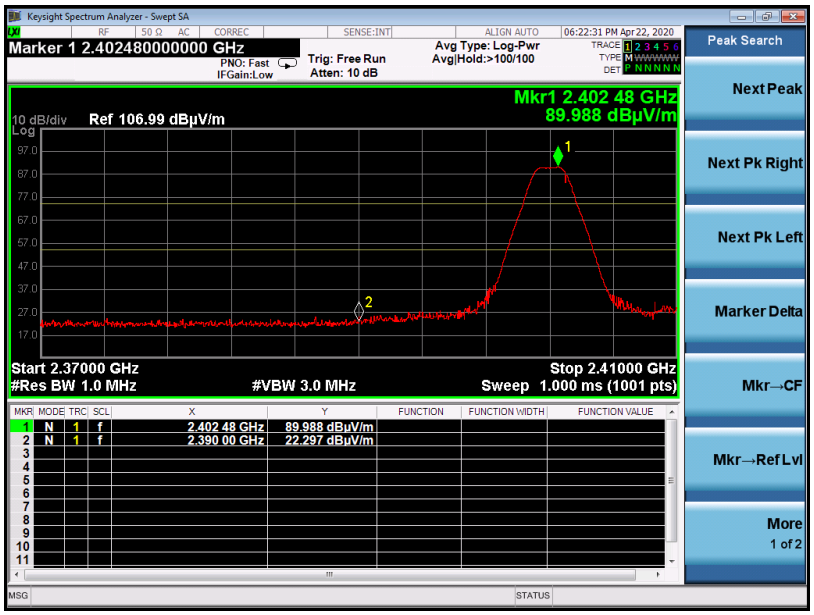


AV

2M

EUT	Open-Source Sensor Beacon	**Model Name**	RUUVITAG
Temperature	25° C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 1	**Antenna**	Horizontal

PK

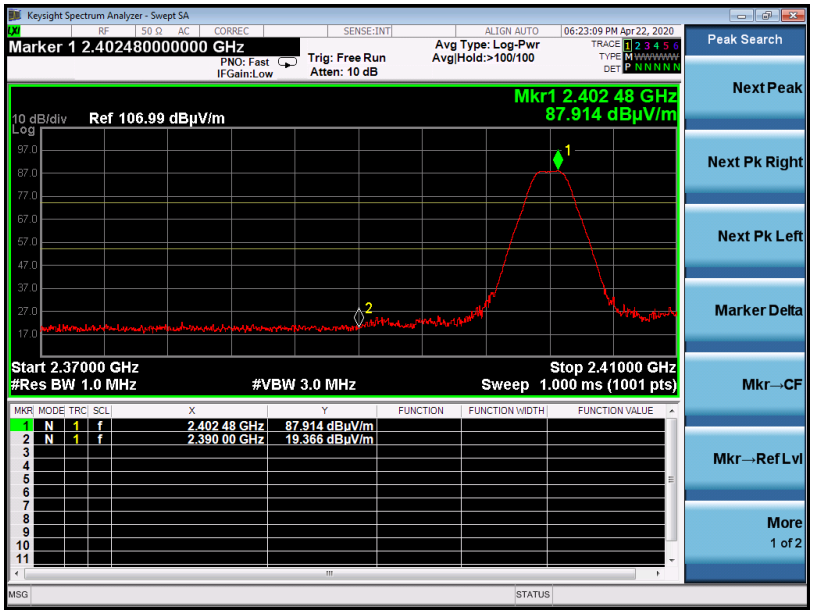


AV

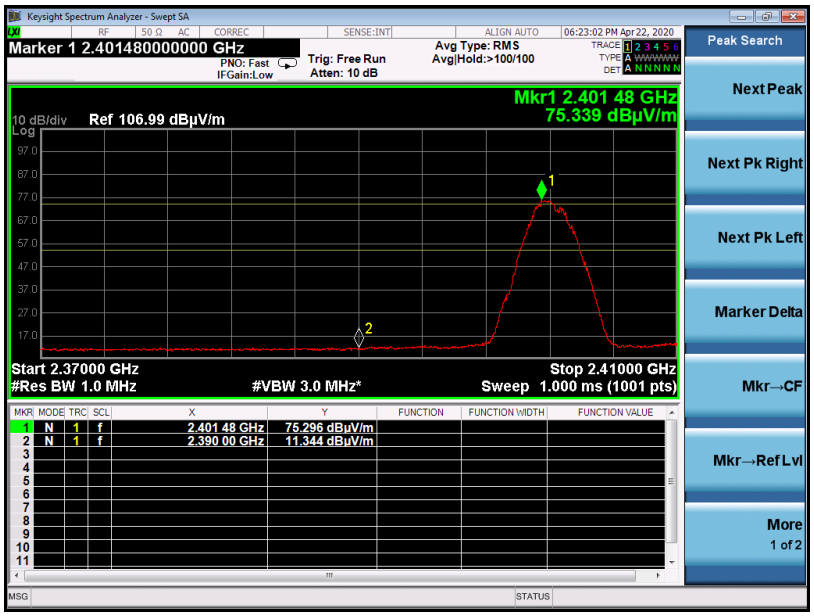
RESULT: PASS

EUT	Open-Source Sensor Beacon	Model Name	RUUVITAG
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical

PK



AV



RESULT: PASS

EUT	Open-Source Sensor Beacon	Model Name	RUUVITAG
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Horizontal

PK

AV

RESULT: PASS

EUT	Open-Source Sensor Beacon	Model Name	RUUVITAG
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Vertical

PK

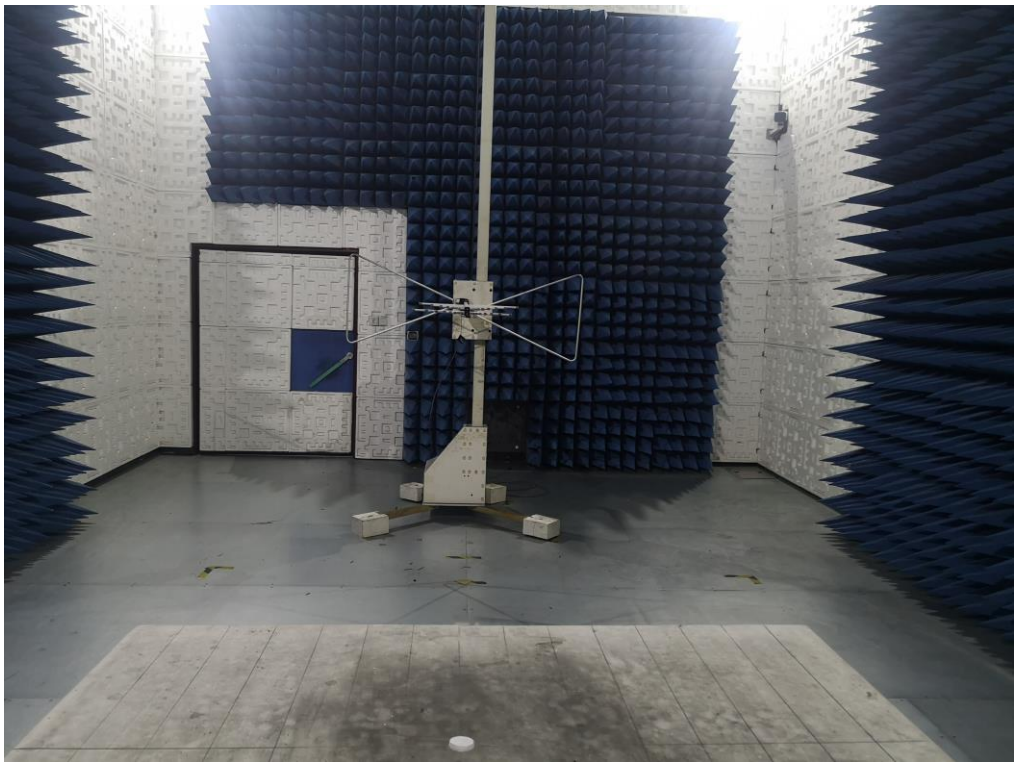
AV

RESULT: PASS

Note: The factor had been edited in the “Input Correction” of the Spectrum Analyzer. So the Amplitude of test plots is equal to Reading level plus the Factor in dB. Use the A dB(µV) to represent the Amplitude. Use the F dB(µV/m) to represent the Field Strength. So A=F.

APPENDIX A: PHOTOGRAPHS OF TEST SETUP

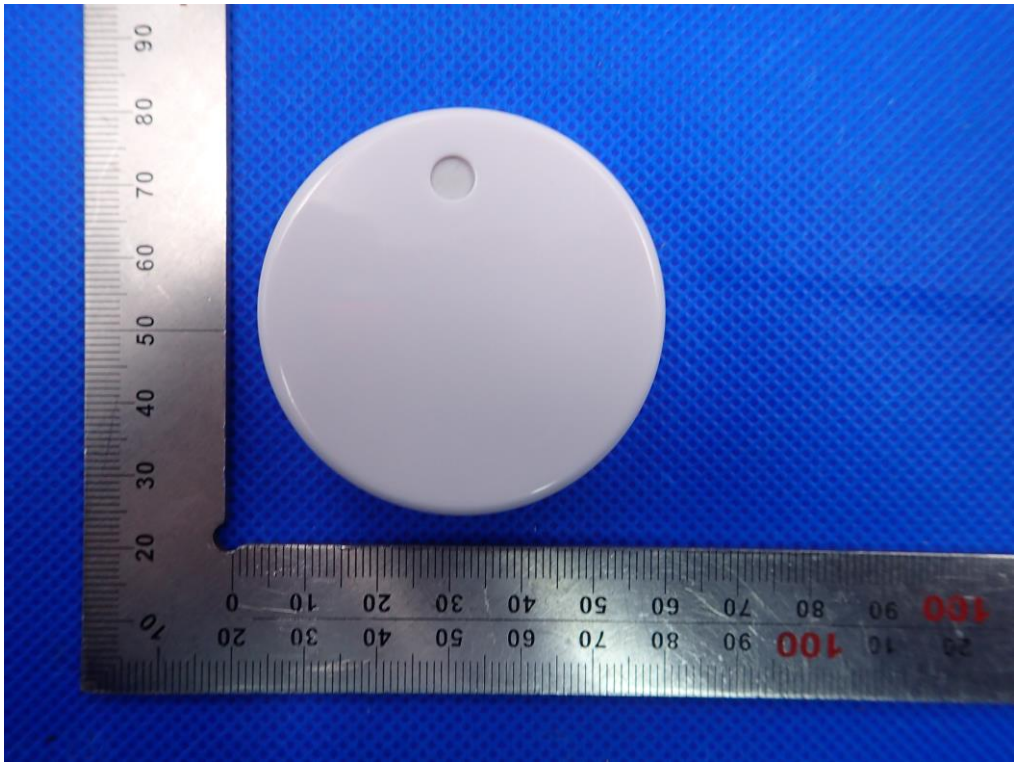
RADIATED EMISSION TEST SETUP BELOW 1GHZ



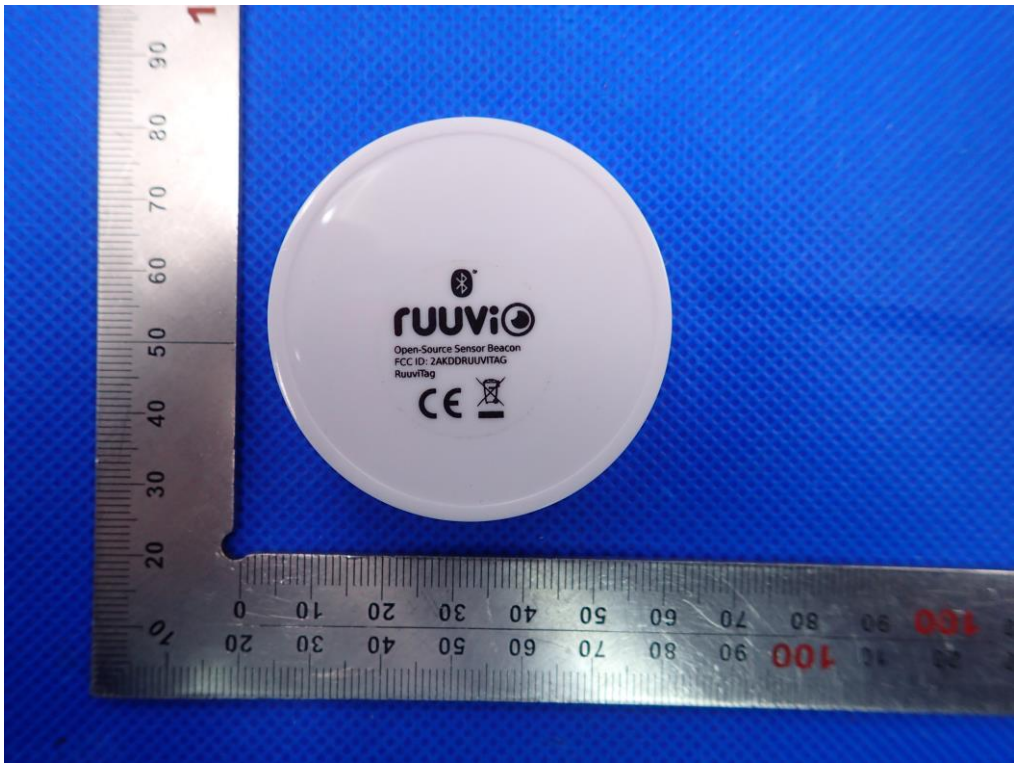
RADIATED EMISSION TEST SETUP ABOVE 1GHZ

APPENDIX B: PHOTOGRAPHS OF EUT

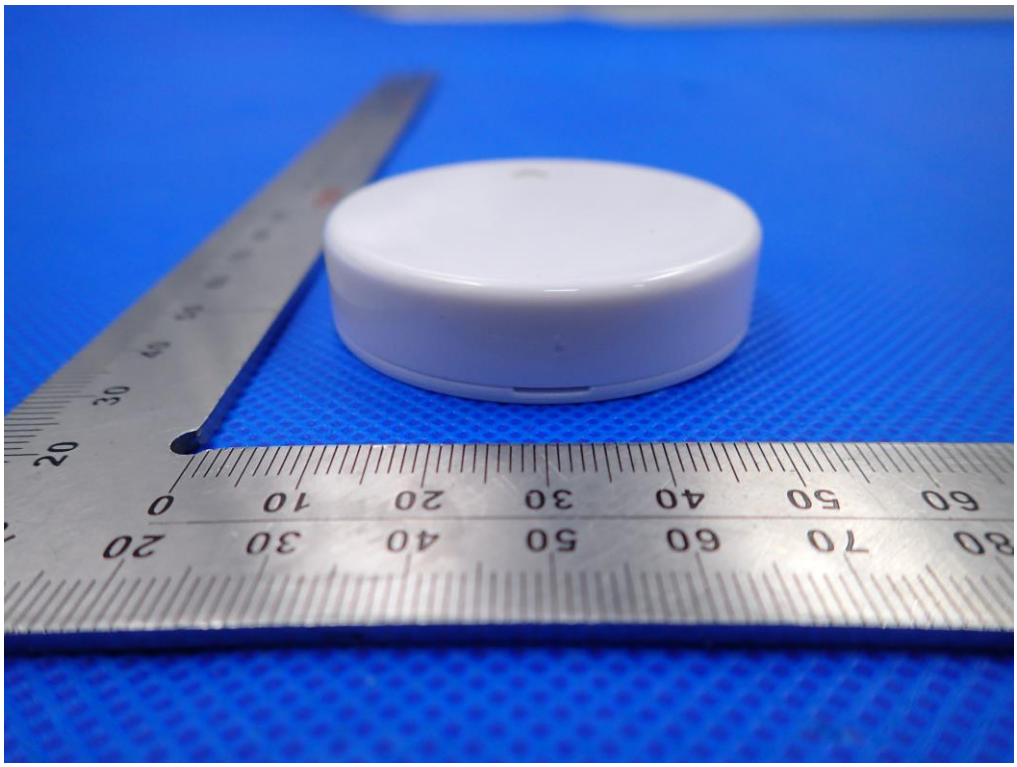
TOP VIEW OF EUT



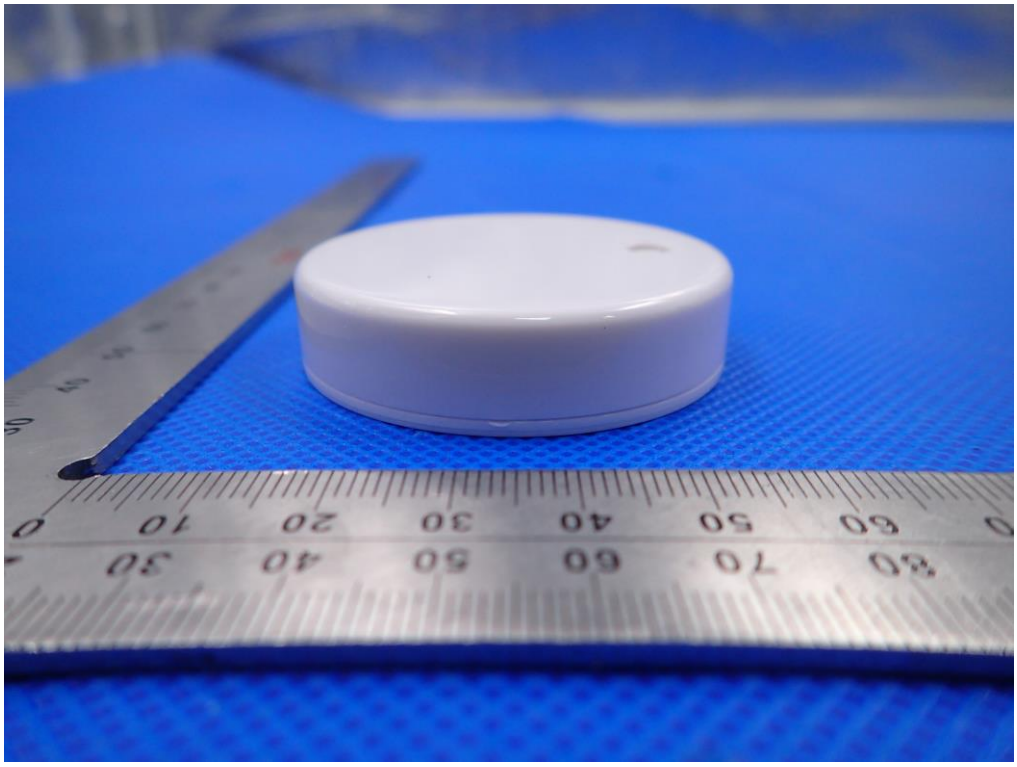
BOTTOM VIEW OF EUT



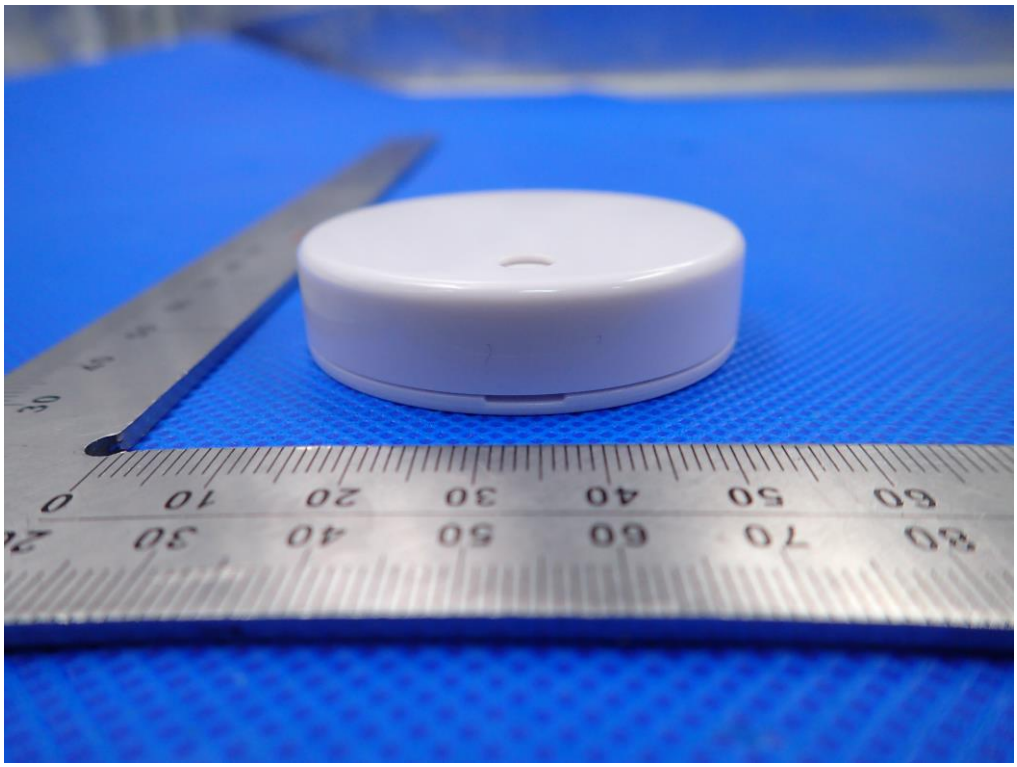
FRONT VIEW OF EUT



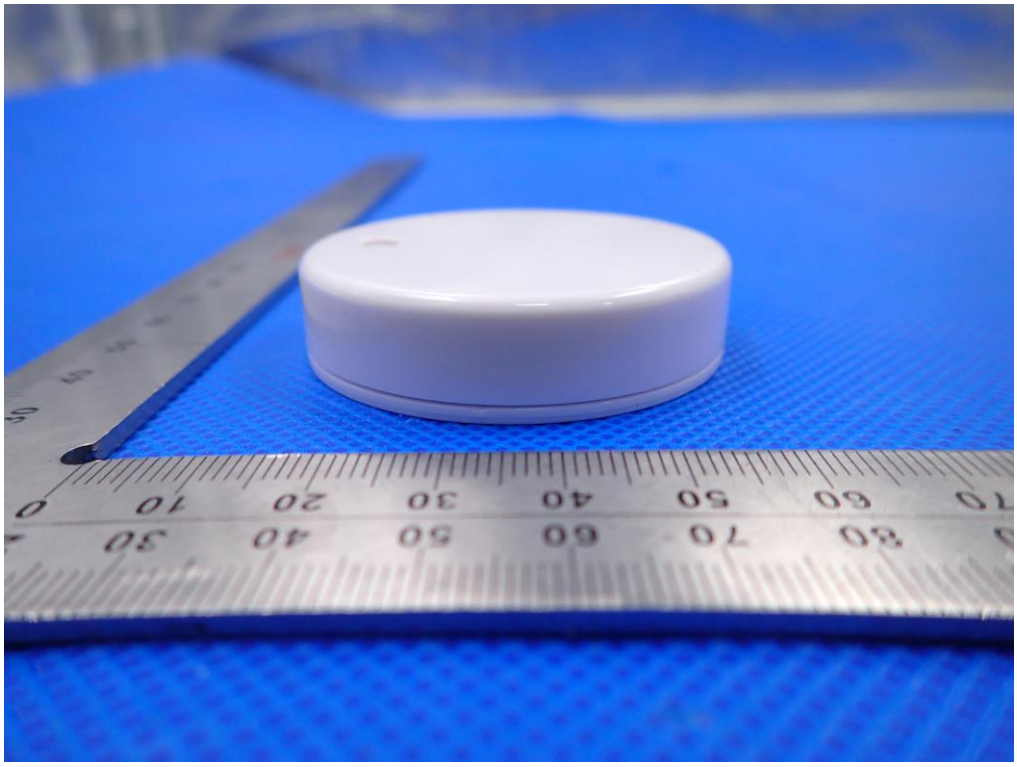
BACK VIEW OF EUT



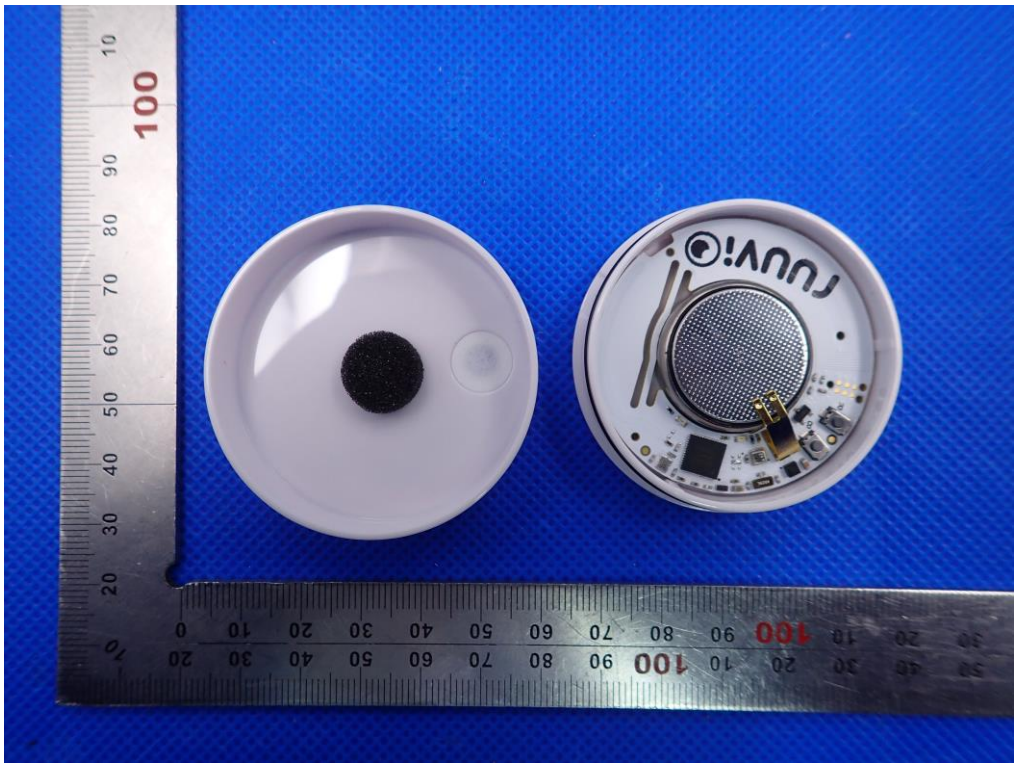
LEFT VIEW OF EUT



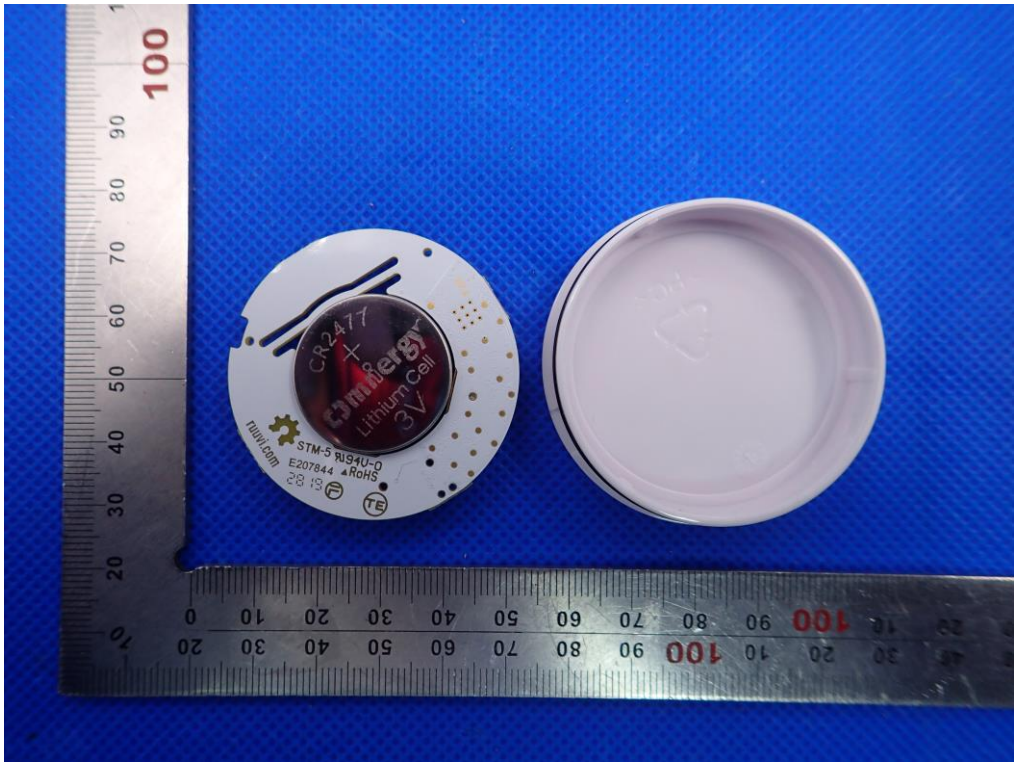
RIGHT VIEW OF EUT



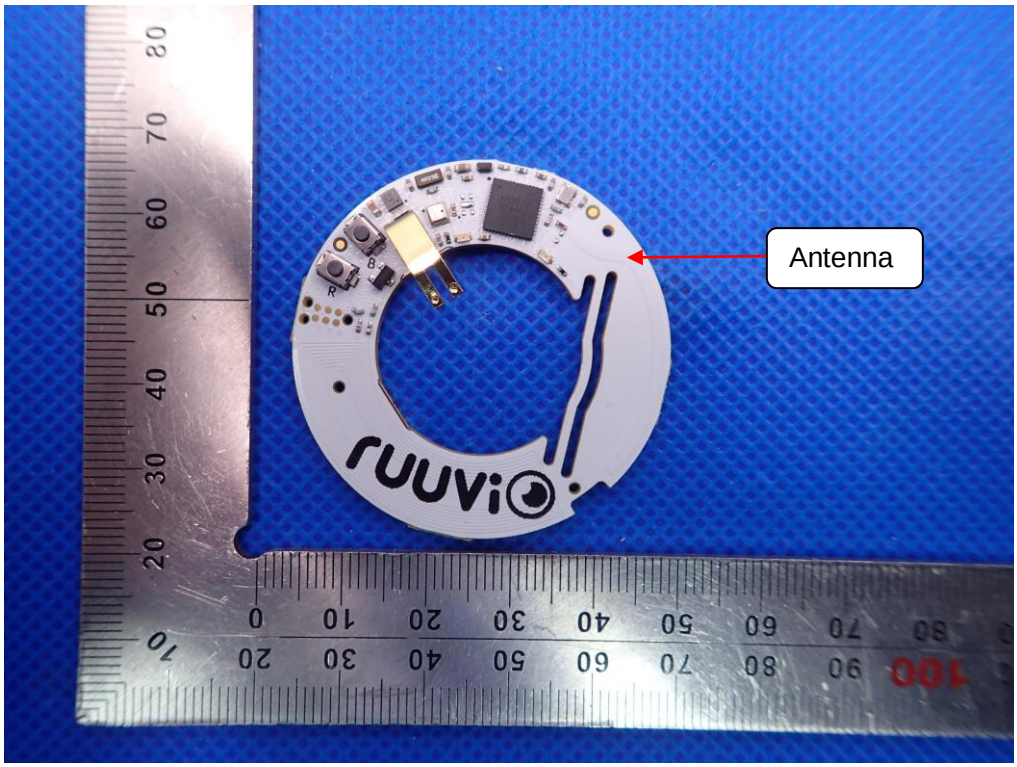
OPEN VIEW OF EUT-1



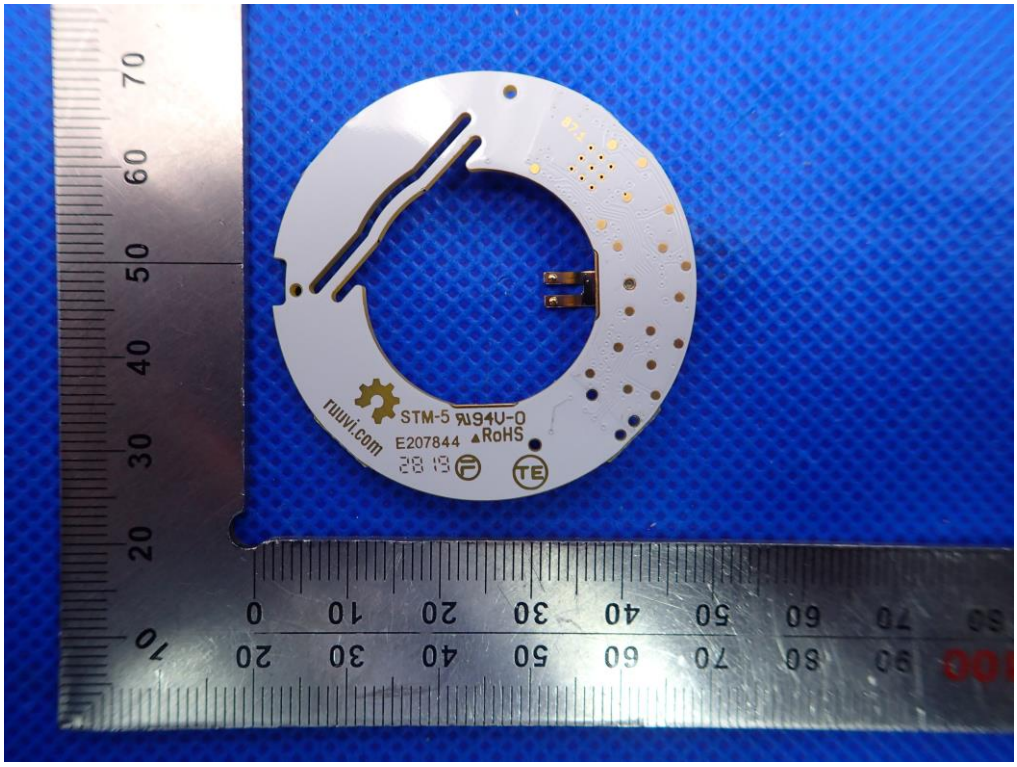
OPEN VIEW OF EUT-2



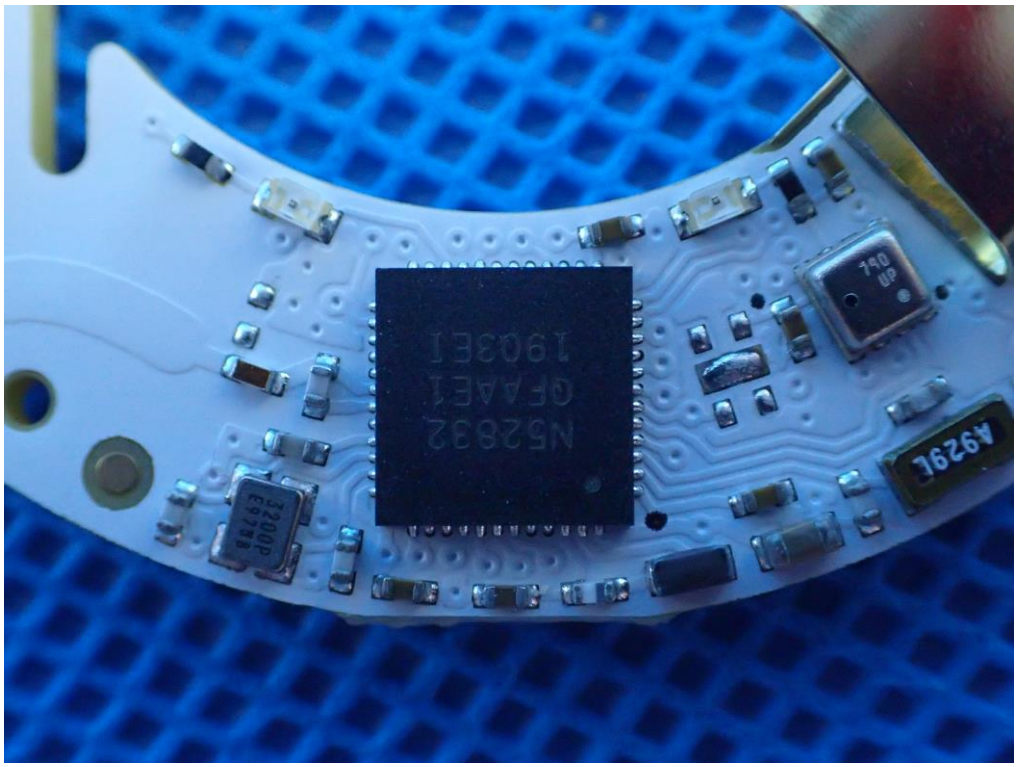
INTERNAL VIEW OF EUT-1



INTERNAL VIEW OF EUT-2



INTERNAL VIEW OF EUT-2



----END OF REPORT----