RF TEST REPORT

ARIB-STD-T66

APPLICANT

Safetrust Inc

MODEL NAME

SA220

REPORT NUMBER

HA220419-SFT-001-R05

TEST REPORT

Date of Issue
May 27, 2022

Test Site
Hyundai C-Tech, Inc. dba HCT America, Inc.
1726 Ringwood Ave, San Jose, CA 95131, USA

Applicant	Safetrust Inc
Applicant Address	8116 Mill Creek Rd, Fremont, CA 94539, U.S.A.
Model Name	SA220
EUT Type	SABRE Module V4
RF Specification	Bluetooth V4.2 LE
Modulation Type	GFSK
Manufacturer	Safetrust Inc
Applicable Standard	ARIB STD-T66, MIC notice 88 Appendix 43
Test Period	May 19, 2022 ~ May 25, 2022

The device bearing the trade name and model specified above, has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures required. The results of testing in this report apply only to the product which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Tested By	**Reviewed By**
Yongsoo Park	Sunwoo Kim
Test Engineer	Technical Manager

REVISION HISTORY

The revision history for this document is shown in table.

TEST REPORT NO.	DATE	DESCRIPTION
HA220419-SFT-001-R05	May 27, 2022	Initial Release

Hyundai C-Tech, Inc. dba HCT America, Inc., 1726 Ringwood Avenue, San Jose, CA 95131, USA TEL: +1-510-933-8848 FAX: +1-510-933-8849

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Hyundai C-Tech, Inc. dba HCT America, Inc., 1726 Ringwood Avenue, San Jose, CA 95131, USA TEL: +1-510-933-8848 FAX: +1-510-933-8849

1. GENERAL INFORMATION

EUT DESCRIPTION

Model	SA220
MIC ID	020-220107
Serial Number	SN4
EUT Type	SABRE Module V4
Power Supply	12 V d.c.
RF Specification	WIFI 5 GHz : 802.11a/n(HT20/40)/ ac(VHT20/40/80) Bluetooth LE MCU (1 Mbps) : nRF52832 Bluetooth LE MESH (1 Mbps) : nRF52832 Bluetooth LE RX (1 Mbps) : nRF52811 (Receive only)
Dimension (L x W x H)	28 mm x 38 mm x 6 mm (L x W x H)
Operating Environment	Indoor and outdoor
Operating Temperature	-20 °C ~ 50 °C

RF SPECIFICATION SUBJECT TO THE REPORT

Equipment Category	Low power data communications system in the 2.4GHz band
RF Specification	Bluetooth LE MCU (1 Mbps) : nRF52832 Bluetooth LE MESH (1 Mbps) : nRF52832 Bluetooth LE RX (1 Mbps) : nRF52811 (Receive only)
Transmitter Chain	1
Frequency Range	2402 MHz – 2480 MHz
Declared Antenna Power	0.3 mW (-5.23 dBm)
Modulation Type	GFSK
Number of Channels	40 Channels
Antenna Specification [1)]	Antenna Type : Chip Antenna Peak Gain : 2.0 dBi
Firmware Version [2)]	1.0.474
Hardware Version [2)]	V4
Date(s) of Tests	May 19, 2022 ~ May 25, 2022

Note(s) :
1. Antenna information is based on the document provided.
2. Firmware and Hardware Versions are provided by the client.

OPERATING FREQUENCY CHANNELS

Bluetooth LE (1M/2M)					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	14	2430	28	2458
1	2404	15	2432	29	2460
2	2406	16	2434	30	2462
3	2408	17	2436	31	2464
4	2410	18	2438	32	2466
5	2412	19	2440	33	2468
6	2414	20	2442	34	2470
7	2416	21	2444	35	2472
8	2418	22	2446	36	2474
9	2420	23	2448	37	2476
10	2422	24	2450	38	2478
11	2424	25	2452	39	2480
12	2426	26	2454	-	-
13	2428	27	2456	-	-

OUTPUT POWER SETTING

The output is preset as declared by the manufacturer.

DECLARED POWER

Frequency Ranges	Declared Conducted Antenna Power
2402 MHz – 2480 MHz	0.3 mW (-5.23 dBm)

TEST ENVIRONMENT CONDITIONS

Items	Environmental Conditions
Temperature	22.5 C
Humidity	45.1 % R.H.

2. FACILITIES AND ACCREDITATIONS

FACILITIES

The SAC (Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at 1726 Ringwood Avenue, San Jose, California 95131, USA.
The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2014) and CISPR Publication 22.

Accredited Laboratory

A2LA has accredited

HYUNDAI C-TECH, INC. DBA HCT AMERICA, INC.

San Jose, CA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 10th day of June 2021.

Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 4201.01
Valid to July 31, 2023

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

3. MEASUREMENT UNCERTAINTY

All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95 % level of confidence. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty
Conducted Emission	± 0.35 dB
Occupied Bandwidth	± 12.4 kHz

4. DESCRIPTION OF TESTS

4.1 FREQUENCY TOLERANCE

LIMIT

Clause 3.2 (4), ARIB STD-T66
Frequency tolerance shall be within ± 50 ppm

TEST SETUP

TEST PROCEDURE

There are two methods for the test item

1) CW Tone method

- Setting of SA is following as: RBW: 1 kHz / VBW: 30 kHz.
- Maker Max. level to get measuring frequency f.

2) 10 dB down method

- Setting of SA is following as: RBW: 30 kHz / VBW: 30 kHz / Trace : Max Hold.
- Display line level = 10 dB down from the maximum point to the left (fL_{OW}) and the right (f_{HIGH})
- Determine the measuring frequency f = (f_{LOW} + f_{HIGH}) / 2

Frequency Tolerance (ppm) = (($f - f_c$) / f_c) * 1000000

The method 1 was used for testing

4.2. OCCUPIED BANDWIDTH

LIMIT

Clause 3.2 (7), ARIB STD-T66

Item	Limits	
Occupied Bandwidth	DSSS	≤ 26 MHz
	OFDM (20 MHz)	≤ 26 MHz
	OFDM (40 MHz)	≤ 38 MHz
	Others	≤ 26 MHz

TEST SETUP

TEST PROCEDURE

1) The EUT output shall be in the hopping mode and connected to the Spectrum Analyzer.
2) Use the following Spectrum Analyzer setting :

- Center Frequency : Operating Frequency;
- SPAN : 2 to 3.5 times the allowable value
- RBW : ≤ 3 % of the allowable value
- VBW: RBW
- Detector Mode: Peak
- Trace Mode : Max Hold
- Sweep : Minimum time to assure the measurement accuracy (In case of bust wave, 1 burst per 1 sample)
- Sweep mode : Continuous

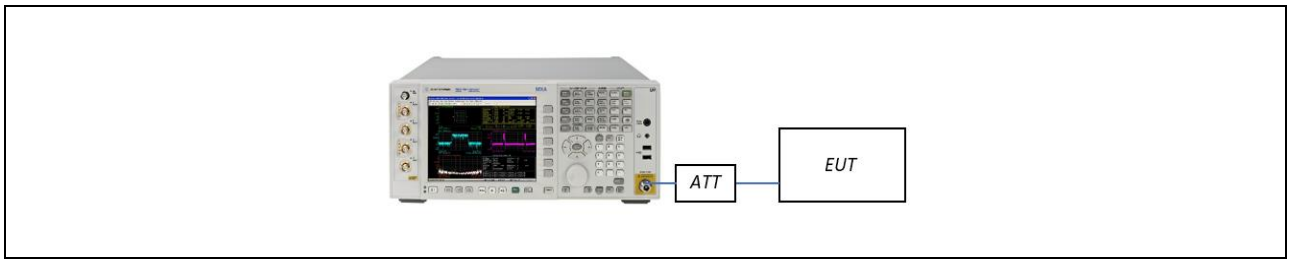
4.3. SPREADING BANDWIDTH / SPREADING FACTOR

LIMIT

Clause 3.2 (8), ARIB STD-T66
In spread spectrum systems, spread bandwidth shall be 500 kHz or more.

Clause 3.2 (9), ARIB STD-T66
In spread spectrum system, spreading factor shall be 5 or more.

TEST SETUP



TEST PROCEDURE

1) The EUT output shall be in the hopping mode and connected to the Spectrum Analyzer.
2) Use the following Spectrum Analyzer setting :

- Center Frequency : Operating Frequency
- SPAN : 2 to 3.5 times the allowable value
- RBW : ≤ 3 % of the allowable value
- VBW: RBW
- Detector Mode: Peak
- Trace Mode : Max Hold
- Sweep : Minimum time to assure the measurement accuracy (In case of bust wave, 1 burst per 1 sample)
- Sweep mode : Continuous

90 % occupied bandwidth measurement profile was used to measure spreading bandwidth.

Note(s) :
Spreading Factor = Spreading Bandwidth / Symbol Rate

4.4 ANTENNA POWER AND TOLERANCES

LIMIT

Clause 3.2 (3), ARIB STD-T66
Tolerance of antenna power shall be +20 % and -80 %.

Clause 3.2 (2), ARIB STD-T66 / Clause 4.3, ARIB STD-T66
Permissible value for antenna power and Max. EIRP is shown in the table below:

Modulation	Frequency Band Used	Antenna Power (Max.)	EIRP (Max.)	
			Omni Directional	Directional Case
DSSS	2400 ~ 2483.5 MHz	10 mW/MHz	12.14 dBm/MHz (16.37 mW/MHz)	22.14 dBm/MHz (163.68 mW/MHz)
OFDM [1)]	2400 ~ 2483.5 MHz	10 mW/MHz	12.14 dBm/MHz (16.37 mW/MHz)	22.14 dBm/MHz (163.68 mW/MHz)
OFDM [2)]	2400 ~ 2483.5 MHz	5 mW/MHz	9.14 dBm/MHz (8.20 mW/MHz)	19.14 dBm/MHz (82.04 mW/MHz)
FHSS	2400 ~ 2483.5 MHz	3 mW/MHz	6.91 dBm/MHz (4.91 mW/MHz)	16.91 dBm/MHz (49.09 mW/MHz)
Other	2400 ~ 2483.5 MHz	10 mW	12.14 dBm (16.37 mW)	22.14 dBm (163.68 mW)
Note(s) : 1) Occupied bandwidth is less than 26 MHz 2) Occupied bandwidth is more than 26 MHz and less than 38 MHz				

TEST SETUP

TEST PROCEDURE

1) Set the spectrum analyzer to have the center frequency the same with the measured carrier.

   - RBW : 1 MHz / VBW : 1 MHz
   - Detector Mode : Peak.

2) Connect the equipment to be measured. Using the following settings of the spectrum analyzer in combination with "max hold" function, find the frequency of highest power output in the power envelope:

   - Center Frequency : Operating Frequency;
   - RBW : 1 MHz / VBW : 1 MHz
   - Detector Mode: Peak
   - Span: 3 x Spectrum Bandwidth;
   - Amplitude: adjust for middle of the instrument's range. The frequency found shall be recorded.

3) The rated power density declared by a manufacturer shall be between + 20% to - 80% power range.

4.5. SPURIOUS EMISSIONS

LIMIT

Clause 3.2 (6), ARIB STD-T66
Permissible mean power of spurious emission of each frequency supplied to a feeder, that is, mean power of spurious emission in the 1 MHz bandwidth at frequency *f* other than frequency band used shall be as follows

Test Frequency	Limit
2387 MHz ≤ *f* < 2400 MHz or 2483.5 MHz < *f* ≤ 2496.5 MHz	≤ 25 uW
2387 MHz > *f* or 2496.5 MHz < *f*	≤ 2.5 uW

TEST SETUP

TEST PROCEDURE

1) The EUT output shall be in the hopping mode and connected to the Spectrum Analyzer.
2) Use the following Spectrum Analyzer setting :

   - RBW:1 MHz / VBW:1 MHz
   - Sweep time: Auto
   - Sweep Mode: Single sweep
   - Detect mode: Positive peak
   - Trace mode: Max hold

3) Set the spectrum analyzer with the frequency range of 30 MHz – 2 387 MHz, then measure the peak to see if the result is less than the limit 2.5 uW.

4) Set the spectrum analyzer with the frequency range of 2 387 MHz – 2 400 MHz, then measure the peak to see if the result is less than the limit 25 uW.

5) Set the spectrum analyzer with the frequency range of 2 483.5 MHz – 2 496.5 MHz, then measure the peak to see if the result is less than the limit 25 uW.

6) Set the spectrum analyzer with the frequency range of 2 496.5 MHz – 12 500 MHz, then measure the peak to see if the result is less than the limit 2.5 uW.

   If the result vale is over the requirement, take total sum of 1 MHz band centered at the spur frequency like ACLP measurement as result value.

4.6. LIMITATION OF COLLATERAL EMISSION OF RECEIVER

LIMIT

Clause 3.3 (1), ARIB STD-T66

In order not to interfere with the function of other radio equipment, the collateral emissions of receiver shall be limited to the following values.

Test Frequency	Limit
30 MHz – 1000 MHz	≤ 4 nW (-54 dBm)
1 GHz – 12.5 GHz	≤ 20 nW (-47 dBm)

TEST SETUP

TEST PROCEDURE

1) The EUT operation shall be in the receiver mode and connected to the Spectrum Analyzer.
2) Use the following Spectrum Analyzer setting :

   - SPAN : 30 MHz to 5 times of carrier frequency
   - RBW: 100 kHz (Below 1 GHz) / 1 MHz (Above 1 GHz)
   - Sweep time: Auto
   - Sweep Mode: Single
   - Detect mode: Positive peak
   - Trace mode: Max hold

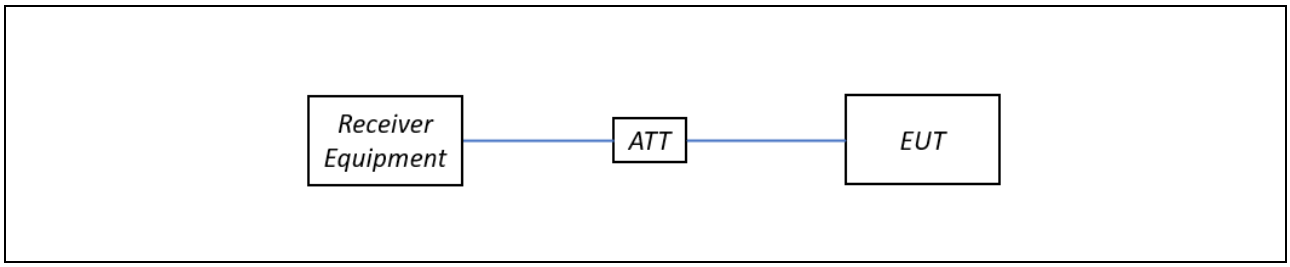
3) Set the spectrum analyzer with the frequency range of 30 MHz – 1 000 MHz, then measure the peak to see the if result is less than the limit 4 nW.
4) Set the spectrum analyzer with the frequency range of 1 GHz – 12.5 GHz, then measure the peak to see the if result is less than the limit 20 nW.

4.7. INTERFACE PREVENTION FUNCTION

LIMIT

Clause 3.4.1 (1), ARIB STD-T66
The radio equipment connected to telecommunication circuit equipment shall be equipment with a device which detects emissions radiated from another radio station and prevents interference, or a device which prevents interference by operation on a receive signal and a signal for diffusion for signal level detection.

TEST SETUP



TEST PROCEDURE

1) In the case that the EUT has the function of automatically transmitting the identification code :

   a. Transmit the predetermined identification codes form EUT.
   b. Check the transmitted identification codes with the demodulator.

2) In the case of receiving the identification code :

   a. Transmit the predetermined identification codes form the counterpart
   b. Check if communication is normal
   c. Transmit the signals other than predetermined ID codes form the counterpart
   d. Check if the EUT stops the transmission, or if it displays that identification codes are different from the predetermined ones

TEST RESULT

Good with correct MAC address

5. SUMMARY OF TEST RESULTS

Test Description	ARIB-STD-T66, Section(s)	Test Limit	Test Result
Frequency Tolerance	Clause 3.2 (4)	Within 50 ppm	PASS
Occupied Bandwidth	Clause 3.2 (7)	≤ 26 MHz	PASS
Spreading Bandwidth	Clause 3.2 (8)	≥ 500 kHz	N/A
Spreading Factor	Clause 3.2 (9)	≥ 5	N/A
Antenna Power and Tolerances	Clause 3.2 (2) Clause 3.2 (3) Clause 4.3	cf. Section 4.4	PASS
Spurious Emissions	Clause 3.2 (6)	cf. Section 4.5	PASS
Limitation of Collateral Emission of Receiver	Clause 3.3 (1)	30 MHz – 1 GHz : 4 nW 1 GHz – 12.5 GHz : 20 nW	PASS
Interface Prevention Function	Clause 3.4.1 (1)	cf. Section 4.7	PASS

6. TEST RESULT

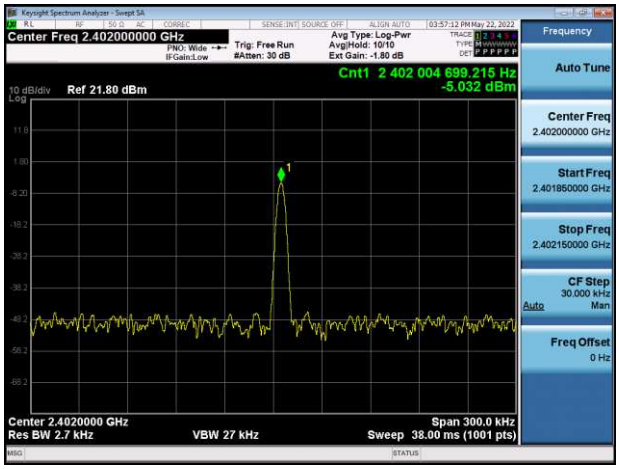
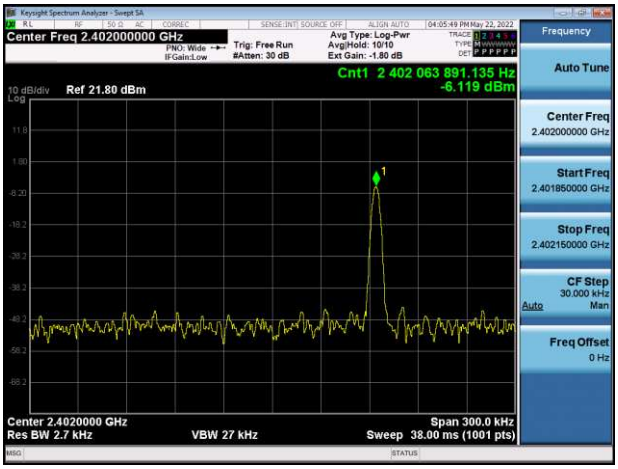
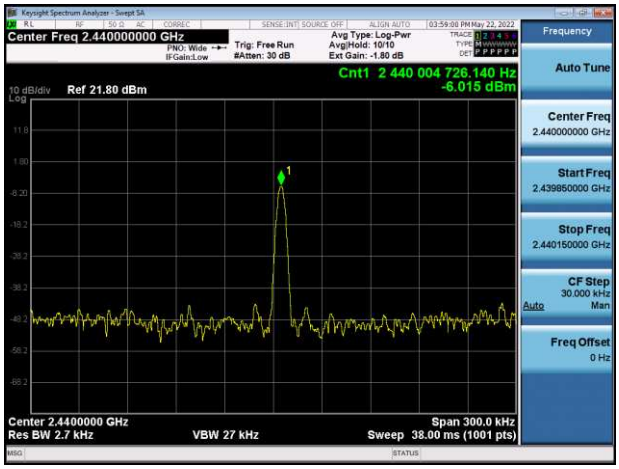
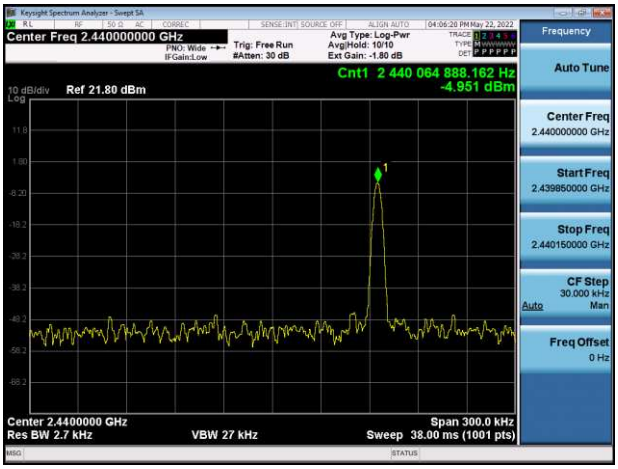
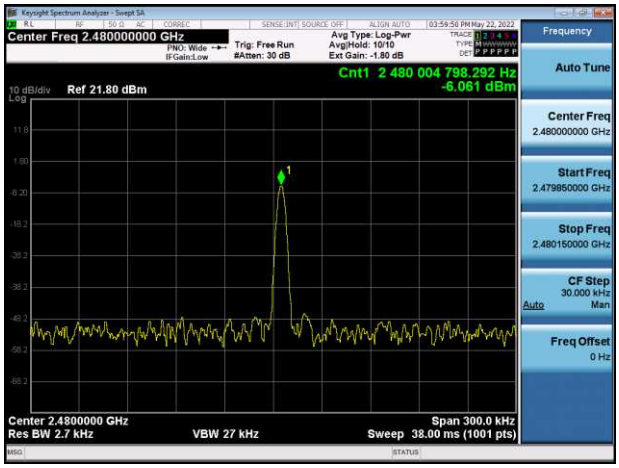
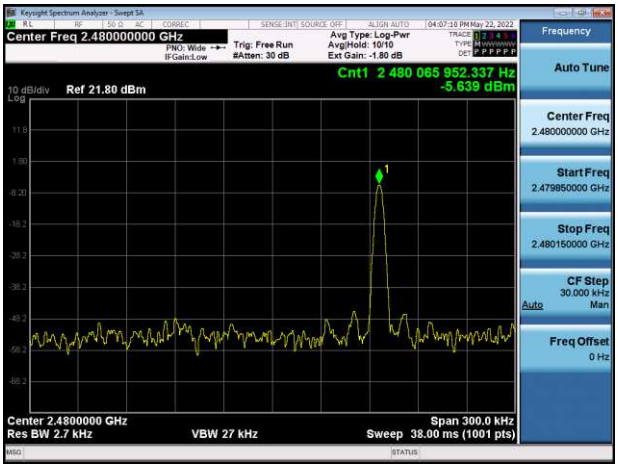
6.1. FREQUENCY TOLERANCE

BLE MCU		Frequency Tolerance (ppm)				Limit
Frequency (MHz)	Channel	Unit	10.8 V d.c.	12 V d.c.	13.2 V d.c.	
2 402	0	MHz	2 402.004 761	2 402.004 716	2 402.004 699	≤ ± 50 ppm
		ppm	1.98	1.96	1.96	
2 440	19	MHz	2 440.004 75	2 440.004 734	2 440.004 726	
		ppm	1.95	1.94	1.94	
2 480	39	MHz	2 480.004 805	2 480.004 799	2 480.004 798	
		ppm	1.94	1.94	1.93	

BLE MESH		Frequency Tolerance (ppm)				Limit
Frequency (MHz)	Channel	Unit	10.8 V d.c.	12 V d.c.	13.2 V d.c.	
2 402	0	MHz	2 402.063 898	2 402.063 899	2 402.063 891	≤ ± 50 ppm
		ppm	26.60	26.60	26.60	
2 440	19	MHz	2 440.064 888	2 440.064 895	2 440.064 892	
		ppm	26.59	26.60	26.60	
2 480	39	MHz	2 480.065 952	2 480.065 955	2 480.065 954	
		ppm	26.59	26.59	26.59	

Note(s) :
CW tone method used

▣ TEST PLOTS

BLE MCU	BLE MESH
Frequency Tolerance (CH0)	**Frequency Tolerance (CH0)**
	
Frequency Tolerance (CH19)	**Frequency Tolerance (CH19)**
	
Frequency Tolerance (CH39)	**Frequency Tolerance (CH39)**
	

Note(s) :
The worst-case plots are included in this report.

6.2. OCCUPIED BANDWIDTH (99% BANDWIDTH)

BLE MCU		Occupied Bandwidth (MHz)			Limit
Frequency (MHz)	Channel	10.8 V d.c.	12 V d.c.	13.2 V d.c.	
2 402	0	1.066	1.064	1.062	≤ 26 MHz
2 440	19	1.065	1.065	1.064	
2 480	39	1.065	1.064	1.067	

BLE MESH		Occupied Bandwidth (MHz)			Limit
Frequency (MHz)	Channel	10.8 V d.c.	12 V d.c.	13.2 V d.c.	
2 402	0	1.064	1.066	1.065	≤ 26 MHz
2 440	19	1.059	1.060	1.061	
2 480	39	1.070	1.065	1.068	

▣ TEST PLOTS

BLE MCU	BLE MESH
99% OBW (CH0)	99% OBW (CH0)
	
99% OBW (CH19)	99% OBW (CH19)
	
99% OBW (CH39)	99% OBW (CH39)
	

Note(s) :
The worst-case plots are included in this report.

6.3. ANTENNA POWER AND TOLERANCES

BLE MCU

BLE MCU		Antenna Power (mW)			Limit
Frequency (MHz)	Channel	10.8 V d.c.	12 V d.c.	13.2 V d.c.	
2 402	0	0.324	0.326	0.325	≤ 10 mW
2 440	19	0.265	0.265	0.266	
2 480	39	0.262	0.263	0.265	

BLE MCU		Tolerances (%)			Limit
Frequency (MHz)	Channel	10.8 V d.c.	12 V d.c.	13.2 V d.c.	
2 402	0	8.11	8.60	8.31	-80 % / +20 % [1]
2 440	19	-11.77	-11.77	-11.24	
2 480	39	-12.72	-12.29	-11.80	

BLE MCU		EIRP. (mW) [2]			Limit
Frequency (MHz)	Channel	10.8 V d.c.	12 V d.c.	13.2 V d.c.	
2 402	0	0.514	0.516	0.515	≤ 16.37 mW
2 440	19	0.420	0.420	0.422	
2 480	39	0.415	0.417	0.419	

Note(s) :
1. Declared Conducted Antenna Power : 0.3 mW
2. EIRP = Power Density (dBm) + Antenna Ganin (dBi)

BLE MESH

BLE MESH		Antenna Power (mW)			Limit
Frequency (MHz)	Channel	10.8 V d.c.	12 V d.c.	13.2 V d.c.	
2 402	0	0.254	0.255	0.258	≤ 10 mW
2 440	19	0.332	0.330	0.331	
2 480	39	0.284	0.284	0.284	

BLE MESH		Tolerances (%)			Limit
Frequency (MHz)	Channel	10.8 V d.c.	12 V d.c.	13.2 V d.c.	
2 402	0	-15.30	-14.90	-14.04	-80 % / +20 % [1]
2 440	19	10.54	10.13	10.32	
2 480	39	-5.24	-5.40	-5.49	

BLE MESH		e.i.r.p. (mW) [2]			Limit
Frequency (MHz)	Channel	10.8 V d.c.	12 V d.c.	13.2 V d.c.	
2 402	0	0.403	0.405	0.409	≤ 16.37 mW
2 440	19	0.526	0.524	0.525	
2 480	39	0.451	0.450	0.449	

Note(s) :
1. Declared Conducted Antenna Power : 0.3 mW
2. EIRP = Power Density (dBm) + Antenna Ganin (dBi)

▣ TEST PLOTS

BLE MCU	BLE MESH
ANTENNA POWER (CH0)	ANTENNA POWER (CH0)
	
ANTENNA POWER (CH19)	ANTENNA POWER (CH19)
	
ANTENNA POWER (CH39)	ANTENNA POWER (CH39)
	

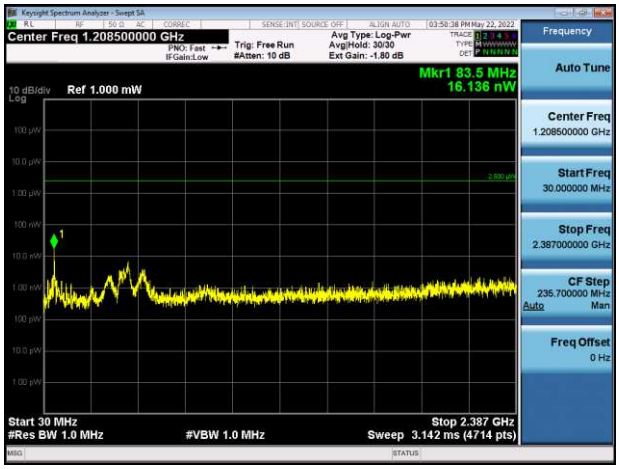
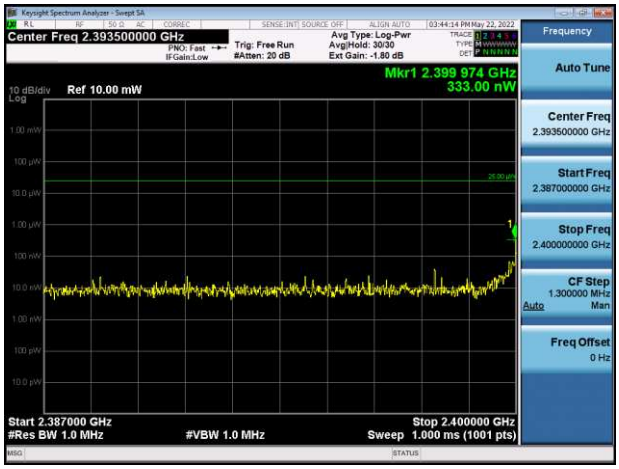
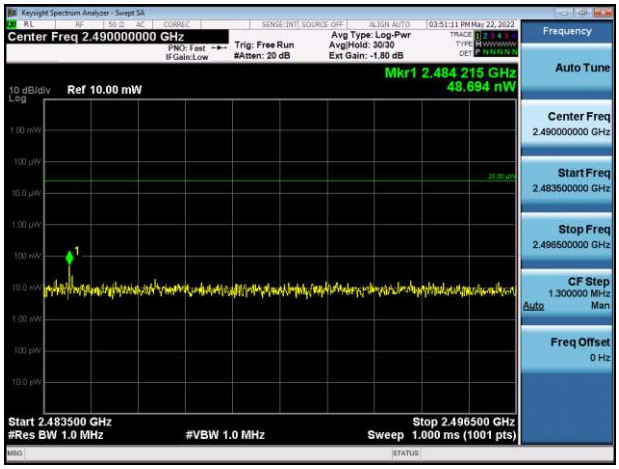
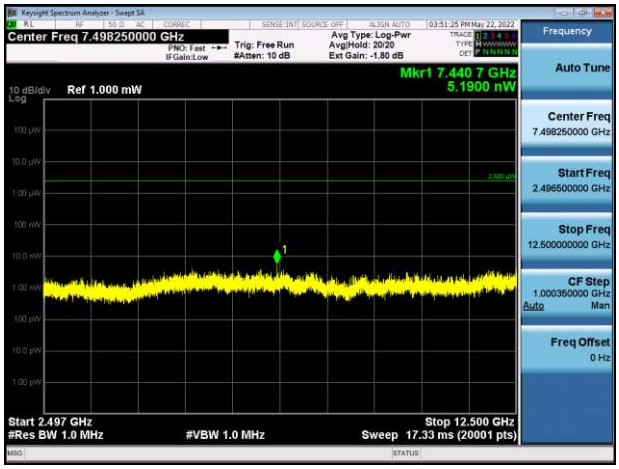
Note(s) :
The worst-case plots are included in this report.

6.4. SPURIOUS EMISSIONS

BLE MCU		Spurious Emissions				Limit
Channel	Frequency Range (MHz)	Unit	10.8 V d.c.	12 V d.c.	13.2 V d.c.	
0	30 MHz – 2387 MHz	uW/MHz	0.013	0.014	0.007	≤ 2.5 uW/MHz
	2387 MHz – 2400 MHz	uW/MHz	0.333	0.113	0.094	≤ 25 uW/MHz
	2483.5 MHz – 2496.5 MHz	uW/MHz	0.021	0.020	0.019	≤ 25 uW/MHz
	2496.5 MHz – 12.5 GHz	uW/MHz	0.004	0.004	0.004	≤ 2.5 uW/MHz
19	30 MHz – 2387 MHz	uW/MHz	0.010	0.008	0.011	≤ 2.5 uW/MHz
	2387 MHz – 2400 MHz	uW/MHz	0.019	0.024	0.020	≤ 25 uW/MHz
	2483.5 MHz – 2496.5 MHz	uW/MHz	0.019	0.020	0.021	≤ 25 uW/MHz
	2496.5 MHz – 12.5 GHz	uW/MHz	0.004	0.005	0.004	≤ 2.5 uW/MHz
39	30 MHz – 2387 MHz	uW/MHz	0.012	0.013	0.016	≤ 2.5 uW/MHz
	2387 MHz – 2400 MHz	uW/MHz	0.024	0.025	0.019	≤ 25 uW/MHz
	2483.5 MHz – 2496.5 MHz	uW/MHz	0.020	0.049	0.033	≤ 25 uW/MHz
	2496.5 MHz – 12.5 GHz	uW/MHz	0.005	0.004	0.004	≤ 2.5 uW/MHz

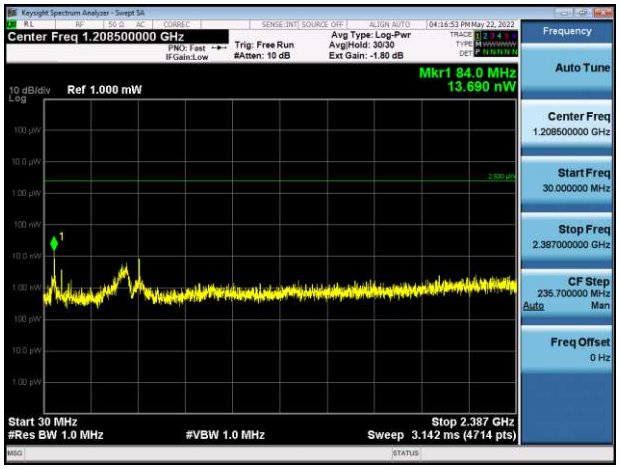
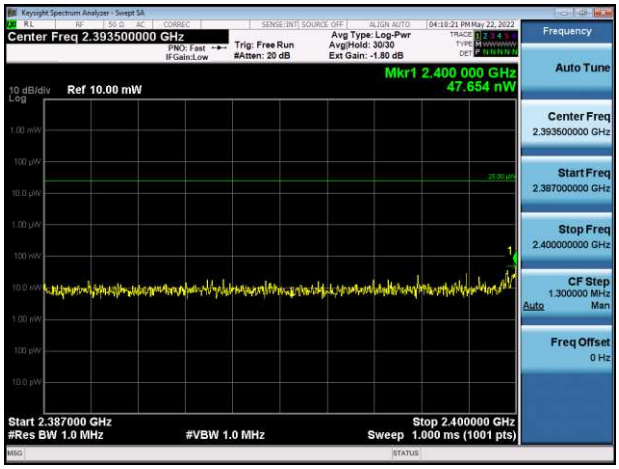
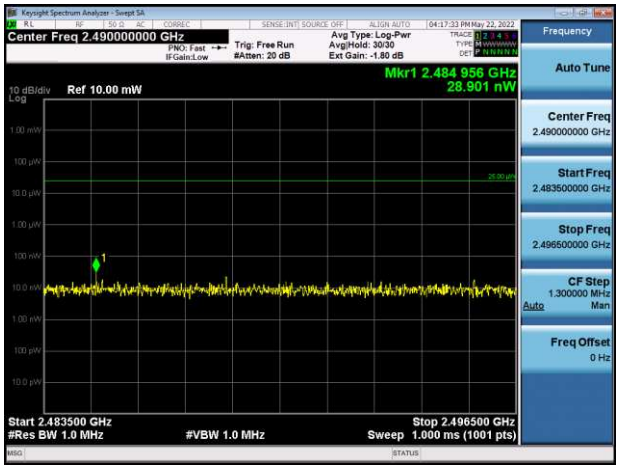
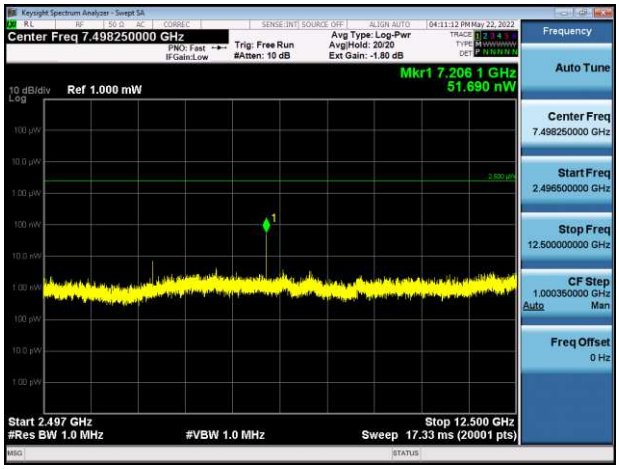
BLE MESH		Spurious Emissions				Limit
Channel	Frequency Range (MHz)	Unit	10.8 V d.c.	12 V d.c.	13.2 V d.c.	
0	30 MHz – 2387 MHz	uW/MHz	0.013	0.013	0.011	≤ 2.5 uW/MHz
	2387 MHz – 2400 MHz	uW/MHz	0.048	0.044	0.047	≤ 25 uW/MHz
	2483.5 MHz – 2496.5 MHz	uW/MHz	0.024	0.023	0.018	≤ 25 uW/MHz
	2496.5 MHz – 12.5 GHz	uW/MHz	0.050	0.052	0.049	≤ 2.5 uW/MHz
19	30 MHz – 2387 MHz	uW/MHz	0.010	0.008	0.009	≤ 2.5 uW/MHz
	2387 MHz – 2400 MHz	uW/MHz	0.022	0.023	0.018	≤ 25 uW/MHz
	2483.5 MHz – 2496.5 MHz	uW/MHz	0.021	0.021	0.018	≤ 25 uW/MHz
	2496.5 MHz – 12.5 GHz	uW/MHz	0.046	0.045	0.044	≤ 2.5 uW/MHz
39	30 MHz – 2387 MHz	uW/MHz	0.010	0.005	0.014	≤ 2.5 uW/MHz
	2387 MHz – 2400 MHz	uW/MHz	0.020	0.023	0.019	≤ 25 uW/MHz
	2483.5 MHz – 2496.5 MHz	uW/MHz	0.021	0.021	0.029	≤ 25 uW/MHz
	2496.5 MHz – 12.5 GHz	uW/MHz	0.045	0.040	0.043	≤ 2.5 uW/MHz

▣ TEST PLOTS

BLE MCU	
BLE 1M (GFSK) : 30 MHz – 2 387 MHz	**BLE 1M (GFSK) : 2 387 MHz – 2 400 MHz**
	
BLE 1M (GFSK) : 2 483.5 MHz – 2 496.5 MHz	**BLE 1M (GFSK): 2 496.5 MHz – 12.5 GHz**
	

Note(s) :
The worst-case plots are included in this report.

▣ TEST PLOTS

BLE MESH	
BLE 2M (GFSK) : 30 MHz – 2 387 MHz	**BLE 2M (GFSK) : 2 387 MHz – 2 400 MHz**
	
BLE 2M (GFSK) : 2 483.5 MHz – 2 496.5 MHz	**BLE 2M (GFSK): 2 496.5 MHz – 12.5 GHz**
	

Note(s) :
The worst-case plots are included in this report.

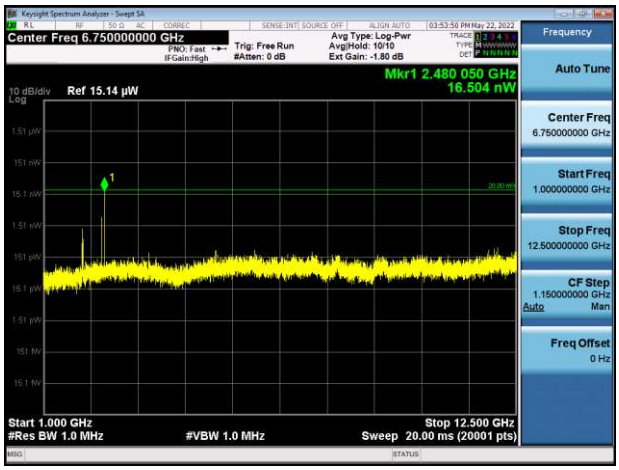
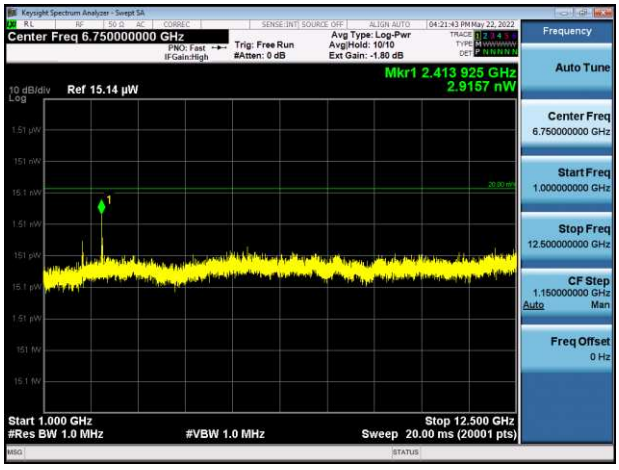
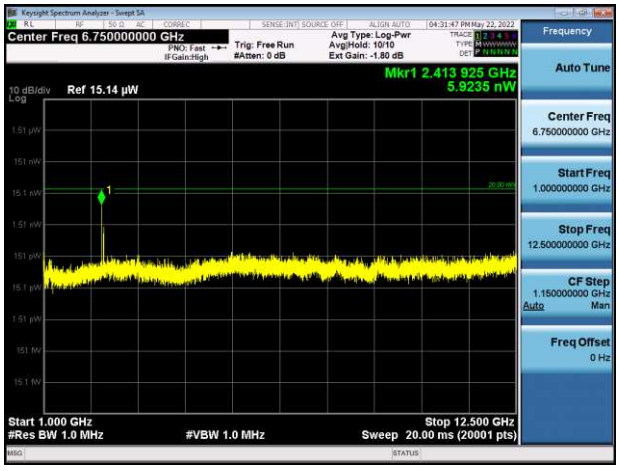
6.5. LIMITATION OF COLLATERAL EMISSION OF RECEIVER

BLE MCU		Receiver Spurious Emissions				Limit
Channel	Frequency Range (MHz)	Unit	10.8 V d.c.	12 V d.c.	13.2 V d.c.	
0	30 MHz – 1000 MHz	nW	1.172	1.064	1.025	≤ 4 nW
	1000 MHz – 12.5 GHz	nW	16.504	1.107	2.461	≤ 20 nW
19	30 MHz – 1000 MHz	nW	1.397	1.383	1.029	≤ 4 nW
	1000 MHz – 12.5 GHz	nW	2.006	2.900	1.878	≤ 20 nW
39	30 MHz – 1000 MHz	nW	0.946	1.180	0.991	≤ 4 nW
	1000 MHz – 12.5 GHz	nW	2.228	7.934	1.024	≤ 20 nW

BLE MESH		Receiver Spurious Emissions				Limit
Channel	Frequency Range (MHz)	Unit	10.8 V d.c.	12 V d.c.	13.2 V d.c.	
0	30 MHz – 1000 MHz	nW	0.993	0.865	1.113	≤ 4 nW
	1000 MHz – 12.5 GHz	nW	2.199	2.487	0.283	≤ 20 nW
19	30 MHz – 1000 MHz	nW	2.785	2.305	1.397	≤ 4 nW
	1000 MHz – 12.5 GHz	nW	1.578	1.704	0.585	≤ 20 nW
39	30 MHz – 1000 MHz	nW	1.819	2.256	1.267	≤ 4 nW
	1000 MHz – 12.5 GHz	nW	0.234	0.234	2.916	≤ 20 nW

BLE RX		Receiver Spurious Emissions				Limit
Channel	Frequency Range (MHz)	Unit	10.8 V d.c.	12 V d.c.	13.2 V d.c.	
0	30 MHz – 1000 MHz	nW	2.004	1.807	1.733	≤ 4 nW
	1000 MHz – 12.5 GHz	nW	0.976	0.496	1.120	≤ 20 nW
19	30 MHz – 1000 MHz	nW	1.973	1.801	1.658	≤ 4 nW
	1000 MHz – 12.5 GHz	nW	0.867	1.333	1.665	≤ 20 nW
39	30 MHz – 1000 MHz	nW	1.798	2.012	1.761	≤ 4 nW
	1000 MHz – 12.5 GHz	nW	5.924	0.264	5.310	≤ 20 nW

▣ TEST PLOTS

BLE MCU : 30 MHz – 1 000 MHz	BLE MCU : 1 000 MHz – 12.5 GHz
	
BLE MESH : 30 MHz – 1 000 MHz	**BLE MESH : 1 000 MHz – 12.5 GHz**
	
BLE RX : 30 MHz – 1 000 MHz	**BLE RX : 1 000 MHz – 12.5 GHz**
	

Note(s) :
The worst-case plots are included in this report.

7. LIST OF TEST EQUIPMENT

No.	Instrument	Model No.	Manufacture	Serial No.	Calibration Date	Calibration Lab	Calibration Method
☒	Signal Analyzer (10 Hz ~ 26.5 GHz)	N9020A	Keysight	MY52091291	2021-11-04	HCT America	Note 2(c)
☒	Attenuator (10 dB, DC ~ 26.5 GHz)	CFAD261002	CERNEX	-	2022-01-13	HCT America	Note 2(c)
☒	DC Power Supply	PAB 18-1A	Kikusui	1350582	2022-01-13	HCT America	Note 2(c)

Note(s) :

1. The calibration interval of the above test instrument is 12 months and the calibration was done in a designated calibration agency under Article 102.18 paragraph(1).
2. Calibration Method :
   (a) Calibration conducted by the National Institute of Information and Communications Technology(NICT) or a designated calibration agency under Article 102-18 paragraph (1) of the Radio Law.
   (b) Calibration conducted pursuant to the provisions of Article 135 or Article 144 of the Measurement Law (Law No. 51 of 1992) Japan Calibration Service System.
   (c) Calibration conducted in foreign countries, which shall be equivalent to the calibration conducted by the NICT or a designated calibration agency under Article 102-18 paragraph (1).
   (d) Calibration conducted by using other equipment that listed above from (a) to (c).

APPENDIX A. TEST SETUP PHOTOS

The setup photos are provided as a separate document.

Hyundai C-Tech, Inc. dba HCT America, Inc., 1726 Ringwood Avenue, San Jose, CA 95131, USA TEL: +1-510-933-8848 FAX: +1-510-933-8849

APPENDIX B. PHOTOGRAPHS OF EUT

B.1. EXTERNAL PHOTOS

The external photos are provided as a separate document.

B.2. INTERNAL PHOTOS

The internal photos are provided as a separate document.

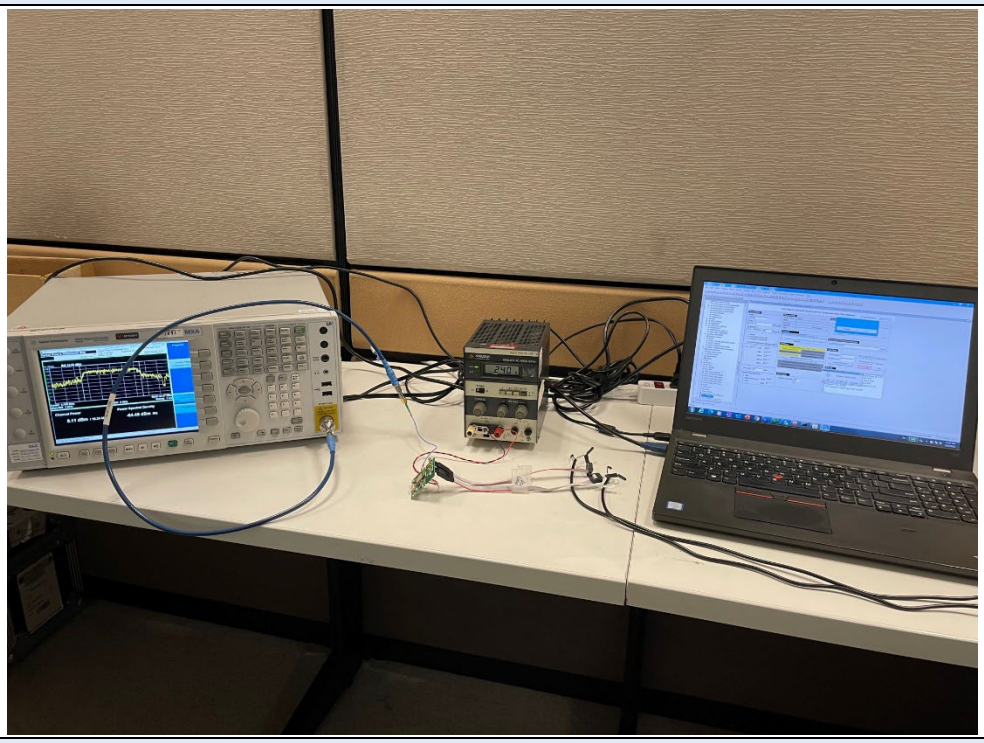
END OF TEST REPORT

Hyundai C-Tech, Inc. dba HCT America, Inc., 1726 Ringwood Avenue, San Jose, CA 95131, USA TEL: +1-510-933-8848 FAX: +1-510-933-8849

APPENDIX A

TEST SETUP PHOTOS

Applicant	Safetust, Inc.
Model Name	SA220
MIC ID	020-220107
Reference Test Report No.:	HA220419-SFT-001-R06

RF Conducted Test

Carrier Sense