

RF TEST REPORT

ARIB-STD-T66

APPLICANT

Socket Mobile, Inc.

MODEL NAME

D600

REPORT NUMBER

HA211208-SOC-004-R01

TEST REPORT

Date of Issue
February 7, 2022

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

Applicant	Socket Mobile, Inc.
Applicant Address	39700 Eureka Drive, Newark, CA 94560, U.S.A.
Model Name	D600
EUT Type	NFC & RFID Contactless Reader/Writer
RF Specification	13.56 MHz : ASK Bluetooth LE V5.0 (1Mbps)
Modulation Type	GFSK
Manufacturer	Socket Mobile, Inc.
Applicable Standard	ARIB STD-T66, MIC notice 88 Appendix 43
Test Period	January 03, 2022 ~ January 10, 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



Yongsoo Park

Test Engineer

Reviewed By



Sunwoo Kim

Technical Manager

REVISION HISTORY

The revision history for this document is shown in table.

TEST REPORT NO.	DATE	DESCRIPTION
HA211208-SOC-004-R01	02/07/2022	Initial Issue

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1. GENERAL INFORMATION

EUT DESCRIPTION

Model	D600
EUT Type	NFC & RFID Contactless Reader/Writer
Power Supply	Battery Charging : 5 V d.c. Lithium-Ion Battery ; 3.7 VDC, 1400 mAh
RF Specification	13.56 MHz : ASK Bluetooth LE V5.0 (1 Mbps) : GFSK
Dimension (L x W x H)	Approx. 132 mm x 38 mm x 47 mm (L x W x H)
Operating Environment	Indoor
Operating Temperature	-20 °C ~ 70 °C

RF SPECIFICATION SUBJECT TO THE REPORT

Equipment Category	Low power data communications system in the 2.4GHz band
RF Specification	Bluetooth LE V5.0 (1Mbps)
Transmitter Chain	1
Frequency Range	2402 MHz – 2480 MHz
Declared Antenna Power	10 mW (10 dBm)
Modulation Type	GFSK
Number of Channels	40 Channels
Antenna Specification ¹⁾	Antenna Type : PCB trace Peak Gain : 1.0 dBi
Firmware Version ²⁾	v1.51 (Build 52)
Hardware Version ²⁾	Rev F
Date(s) of Tests	January 03, 2022 ~ January 10, 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

BLE 1M					
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
2480	10 mW (10 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.



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

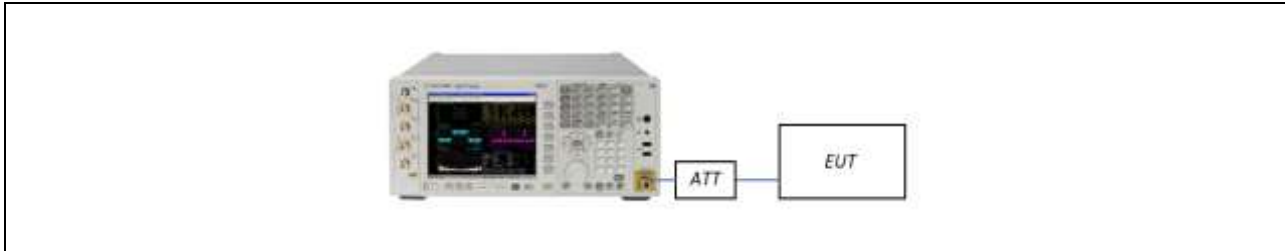
4.1 FREQUENCY TOLERANCE

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.
- Make 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 (f_{LOW}) and the right (f_{HIGH})
- Determine the measuring frequency $f = (f_{LOW} + f_{HIGH}) / 2$

$$\text{Frequency Tolerance (ppm)} = ((f - f_c) / f_c) * 1000000$$

The method 1 was used for testing

Note(s) :

$$\text{Frequency Tolerance (ppm)} = ((f - f_c) / f_c) * 1000000$$

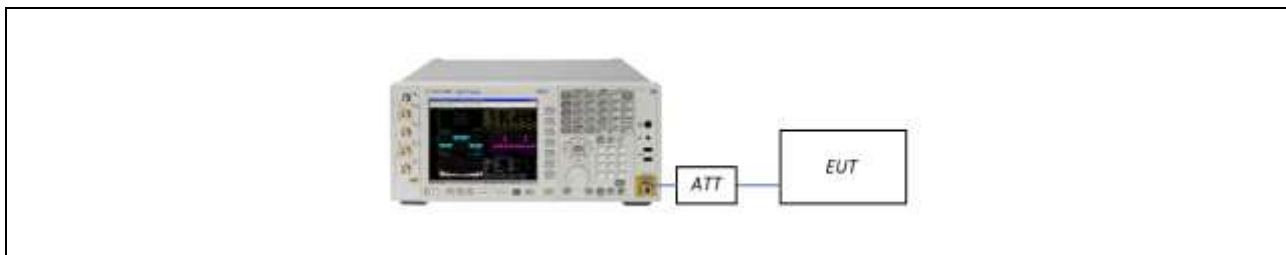
4.2. OCCUPIED BANDWIDTH

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 burst wave, 1 burst per 1 sample)
 - Sweep mode : Continuous

4.3. SPREADING BANDWIDTH / SPREADING FACTOR

LIMIT

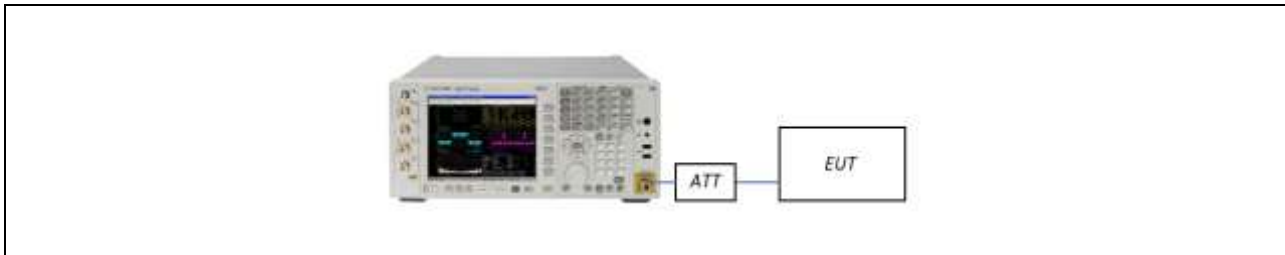
Clause 3.2 (8), ARIB STD-T66

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 : $\leq 3\%$ of the allowable value
 - VBW: RBW
 - Detector Mode: Peak
 - Trace Mode : Max Hold
 - Sweep : Minimum time to assure the measurement accuracy (In case of burst 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 / Modulation Rate

4.4 ANTENNA POWER AND TOLERANCES

LIMIT

Clause 3.2 (3), ARIB STD-T66

Tolerance of antenna power shall be +20 % and -80 %.

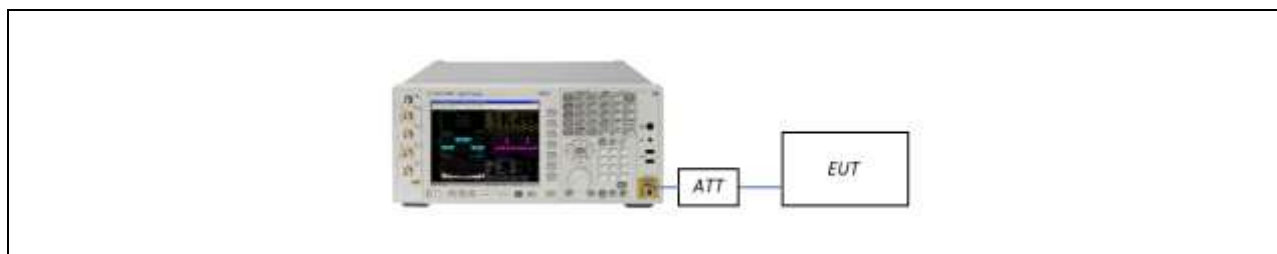
Clause 3.2 (2), ARIB STD-T66 / Clause 4.3, ARIB STD-T66

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

- Set the spectrum analyzer to have the center frequency the same with the measured carrier.
 - RBW : 1 MHz / VBW : 1 MHz
 - Detector Mode : Peak.
- 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.
- The rated power density declared by a manufacturer shall be between + 20% to - 80% power range.

4.5. SPURIOUS EMISSIONS

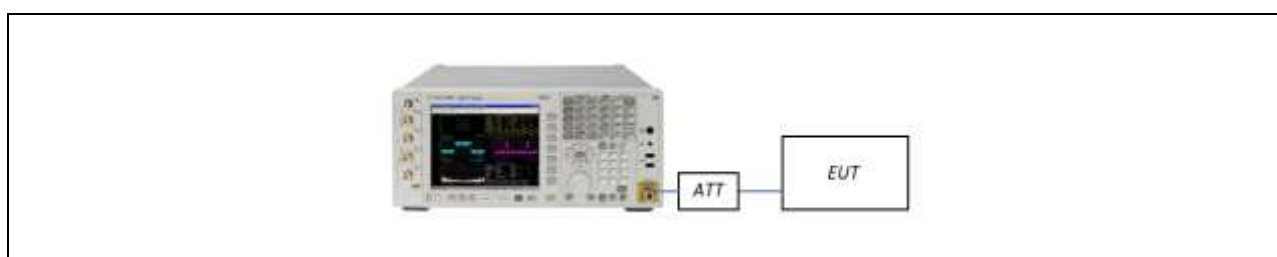
LIMIT

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
$2387 \text{ MHz} \leq f < 2400 \text{ MHz}$ or $2483.5 \text{ MHz} < f \leq 2496.5 \text{ MHz}$	$\leq 25 \text{ uW}$
$2387 \text{ MHz} > f$ or $2496.5 \text{ MHz} < f$	$\leq 2.5 \text{ uW}$

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 value 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

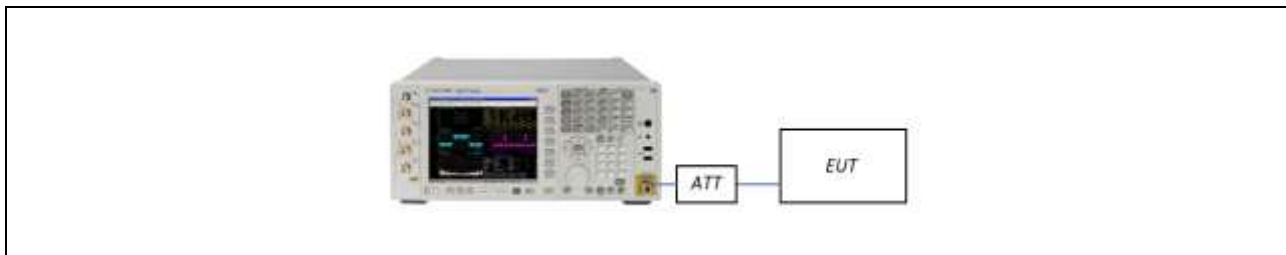
LIMIT

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	$\leq 4 \text{ nW}$ (-54 dBm)
1 GHz – 12.5 GHz	$\leq 20 \text{ nW}$ (-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.

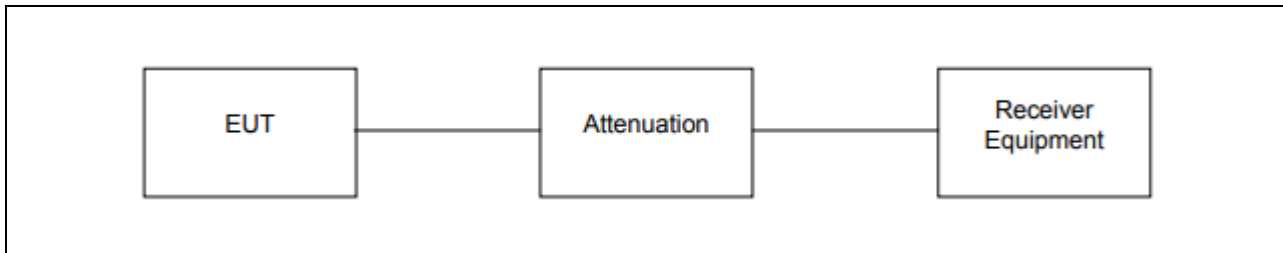
4.7. INTERFACE PREVENTION FUNCTION

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

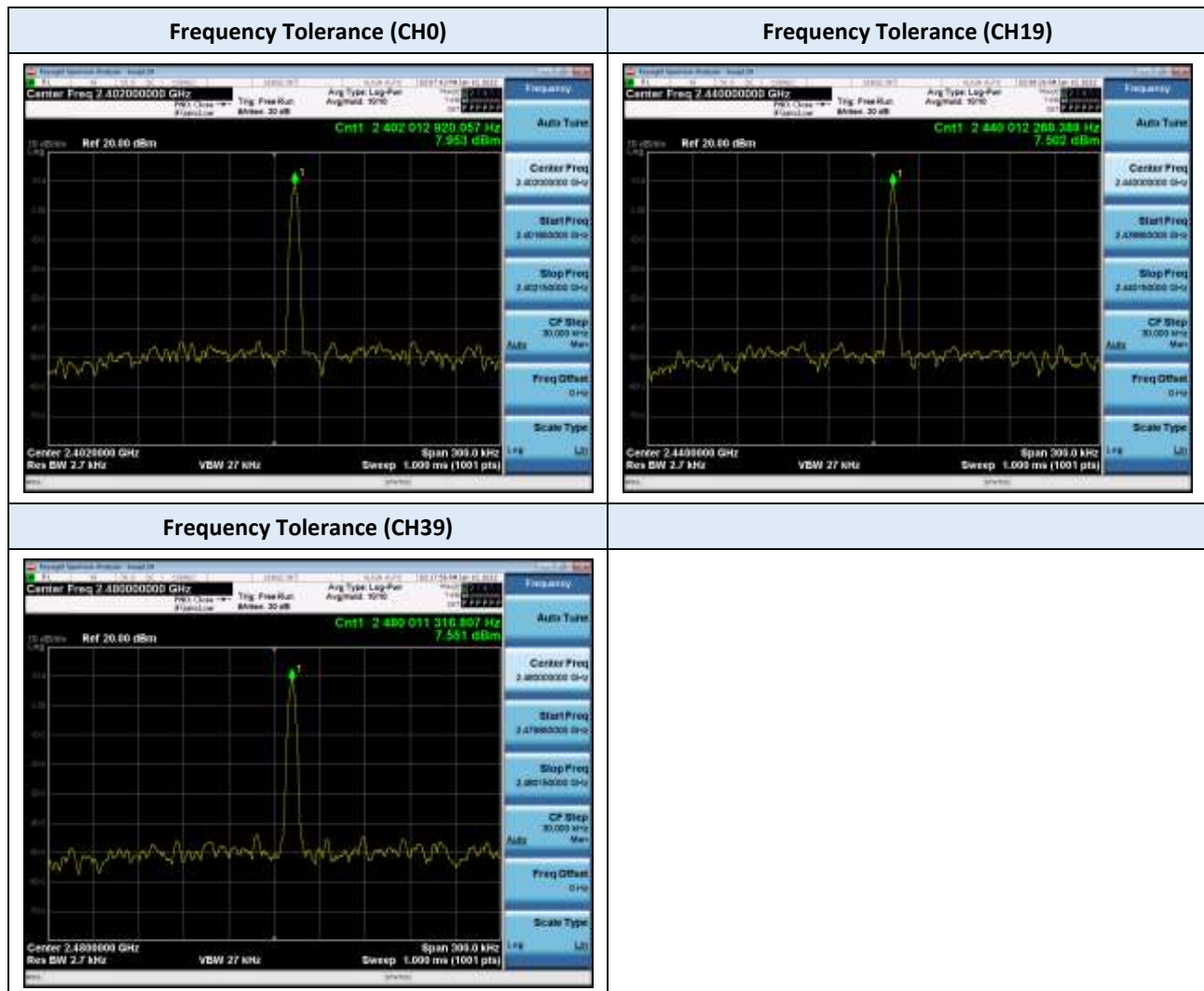
Test Description	ARIB-STD-T66, Section(s)	Test Limit	Test Result
Frequency Tolerance	Clause 3.2 (4)	Within 50 ppm	PASS
Occupied Bandwidth	Clause 3.2 (7)	≤ 26 MHz	PASS
Spreading Bandwidth	Clause 3.2 (8)	≥ 500 kHz	N/A
Spreading Factor	Clause 3.2 (9)	≥ 5	N/A
Antenna Power and Tolerances	Clause 3.2 (2) Clause 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

Frequency (MHz)	Channel	Frequency Tolerance (ppm)				Limit
		Unit	3.33 V d.c.	3.7 V d.c.	4.07 V d.c.	
2 402	0	MHz	2 402.012 685	2 402.012 843	2 402.012 920	$\leq \pm 50$ ppm
		ppm	5.28	5.35	5.38	
2 440	19	MHz	2 440.012 198	2 440.012 264	2 440.012 268	
		ppm	5.00	5.03	5.03	
2 480	39	MHz	2 480.011 243	2 480.011 291	2 480.011 317	
		ppm	4.53	4.55	4.56	

TEST PLOTS



Note(s) :

The worst-case plots are included in this report.

6.2. OCCUPIED BANDWIDTH (99% BANDWIDTH)

Frequency (MHz)	Channel	Occupied Bandwidth (MHz)			Limit
		3.33 V d.c.	3.7 V d.c.	4.07 V d.c.	
2 402	0	1.04	1.04	1.04	≤ 26 MHz
2 440	19	1.04	1.04	1.04	
2 480	39	1.04	1.04	1.04	

TEST PLOTS



Note(s) :

The worst-case plots are included in this report.

6.3. ANTENNA POWER AND TOLERANCES

Frequency (MHz)	Channel	Antenna Power (mW)			Limit
		3.33 V d.c.	3.7 V d.c.	4.07 V d.c.	
2 402	0	6.298	6.291	6.294	≤ 10 mW
2 440	19	5.679	5.710	5.677	
2 480	39	5.749	5.777	5.749	

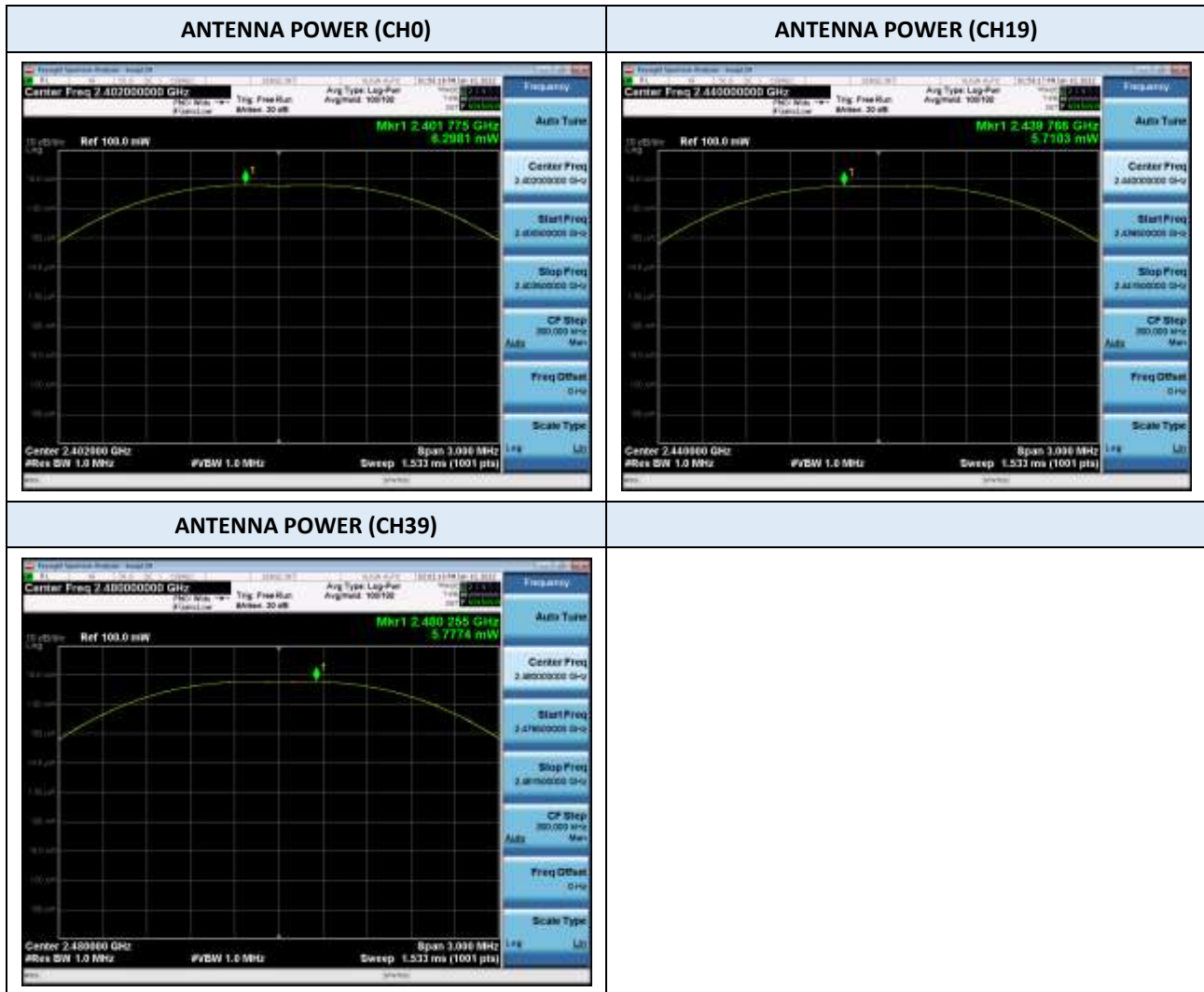
Frequency (MHz)	Channel	Tolerances (%)			Limit
		3.33 V d.c.	3.7 V d.c.	4.07 V d.c.	
2 402	0	-37.02	-37.09	-37.07	-80 % / +20 %
2 440	19	-43.21	-42.90	-43.23	
2 480	39	-42.51	-42.23	-42.51	

Frequency (MHz)	Channel	e.i.r.p. (mW)			Limit
		3.33 V d.c.	3.7 V d.c.	4.07 V d.c.	
2 402	0	7.929	7.920	7.923	≤ 16.37 mW
2 440	19	7.149	7.189	7.147	
2 480	39	7.238	7.273	7.238	

Note(s) :

1. EIRP = Power Density (dBm) + Antenna Gain (dBi)

TEST PLOTS



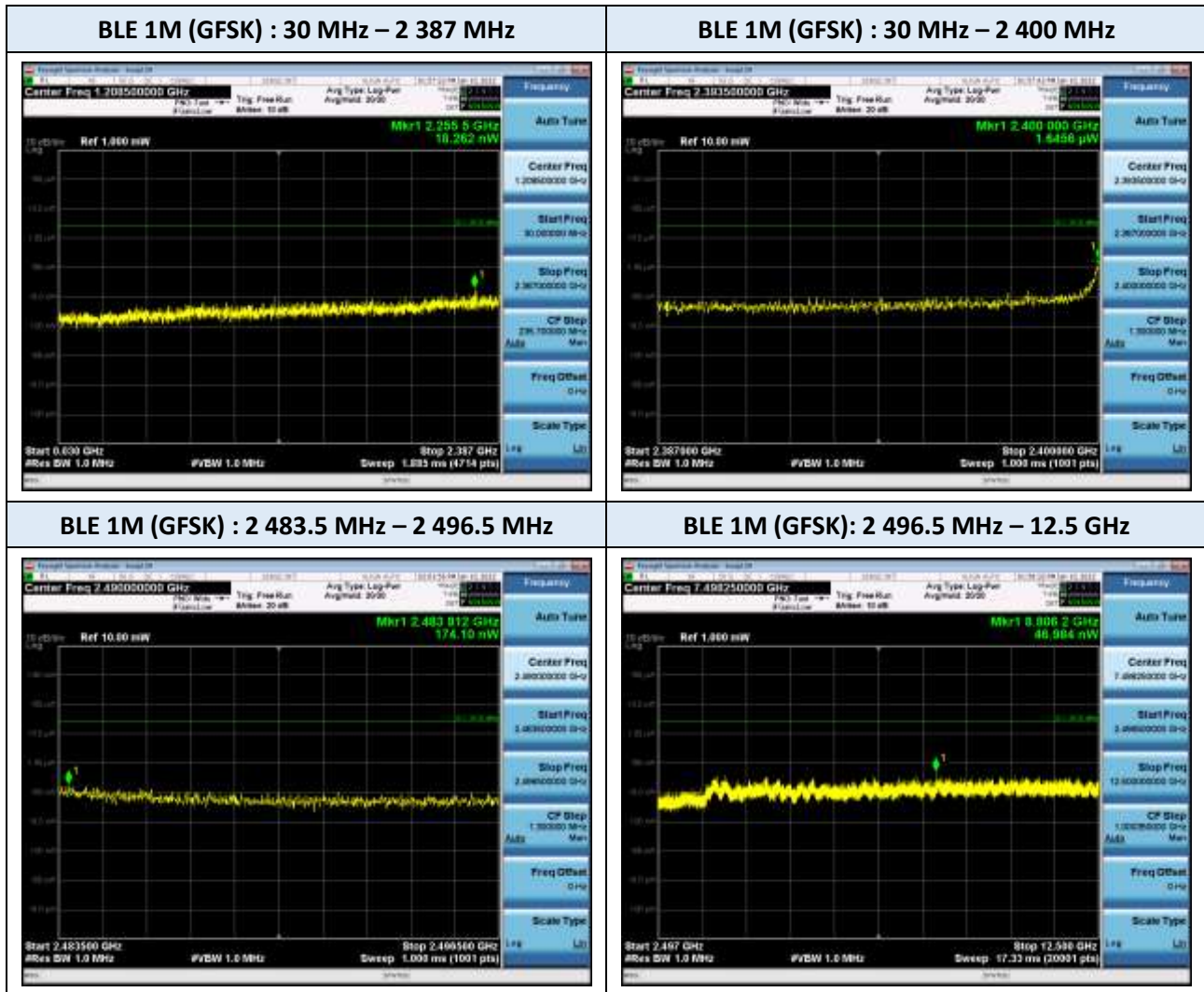
Note(s) :

The worst-case plots are included in this report.

6.6. SPURIOUS EMISSIONS

Channel	Frequency Range (MHz)	Spurious Emissions				Limit
		Unit	3.33 V d.c.	3.7 V d.c.	4.07 V d.c.	
0	30 MHz – 2387 MHz	MHz	2 255.472	2 285.979	2 362.995	≤ 2.5 uW/MHz
		uW/MHz	0.018	0.015	0.018	
	2387 MHz – 2400 MHz	MHz	2 400.000	2 400.000	2 400.000	≤ 25 uW/MHz
		uW/MHz	1.646	1.408	1.308	
	2483.5 MHz – 2496.5 MHz	MHz	2 494.238	2 487.036	2 483.721	≤ 25 uW/MHz
		uW/MHz	0.106	0.118	0.107	
19	30 MHz – 2387 MHz	MHz	2 375.498	2 349.992	2 261.473	≤ 2.5 uW/MHz
		uW/MHz	0.017	0.013	0.013	
	2387 MHz – 2400 MHz	MHz	2 391.784	2 391.966	2 394.033	≤ 25 uW/MHz
		uW/MHz	0.101	0.121	0.090	
	2483.5 MHz – 2496.5 MHz	MHz	2 488.323	2 486.243	2 488.336	≤ 25 uW/MHz
		uW/MHz	0.102	0.097	0.101	
	2496.5 MHz – 12.5 GHz	MHz	11 098.009	12 258.916	9 652.004	≤ 2.5 uW/MHz
		uW/MHz	0.040	0.039	0.046	
39	30 MHz – 2387 MHz	MHz	2 363.495	2 192.959	1 957.409	≤ 2.5 uW/MHz
		uW/MHz	0.013	0.015	0.013	
	2387 MHz – 2400 MHz	MHz	2 393.656	2 398.895	2 389.678	≤ 25 uW/MHz
		uW/MHz	0.104	0.093	0.101	
	2483.5 MHz – 2496.5 MHz	MHz	2 483.500	2 484.592	2 483.812	≤ 25 uW/MHz
		uW/MHz	0.161	0.141	0.174	
	2496.5 MHz – 12.5 GHz	MHz	11 093.508	11 774.246	3 814.961	≤ 2.5 uW/MHz
		uW/MHz	0.041	0.042	0.042	

TEST PLOTS



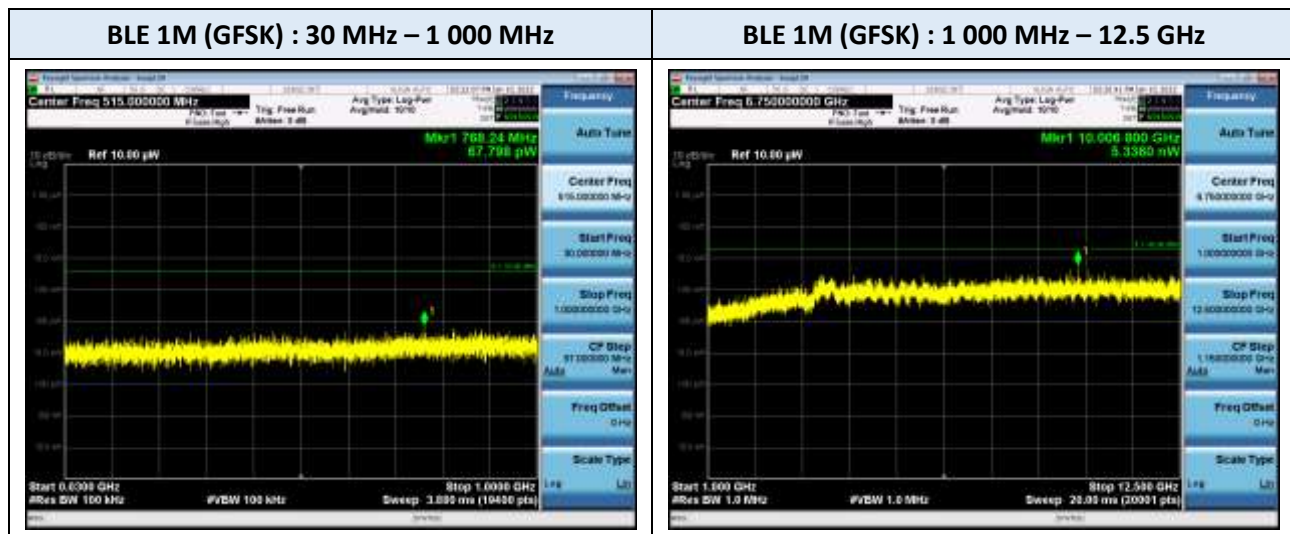
Note(s) :

The worst-case plots are included in this report.

6.7. LIMITATION OF COLLATERAL EMISSION OF RECEIVER

Channel	Frequency Range (MHz)	Unit	Collateral Emissions			Limit
			3.33 V d.c.	3.7 V d.c.	4.07 V d.c.	
0	30 MHz – 1000 MHz	MHz	886.194	907.095	784.139	≤ 4 nW
		nW	0.062	0.057	0.062	
	1000 MHz – 12.5 GHz	MHz	10 006.800	10 549.600	7 985.100	≤ 20 nW
		nW	5.336	3.527	3.595	
19	30 MHz – 1000 MHz	MHz	768.238	876.994	824.141	≤ 4 nW
		nW	0.068	0.057	0.066	
	1000 MHz – 12.5 GHz	MHz	11 813.450	10 277.050	9 115.550	≤ 20 nW
		nW	3.873	3.541	3.875	
39	30 MHz – 1000 MHz	MHz	725.786	830.341	775.838	≤ 4 nW
		nW	0.056	0.064	0.055	
	1000 MHz – 12.5 GHz	MHz	8 625.075	4 048.650	4 921.500	≤ 20 nW
		nW	3.875	3.059	3.457	

TEST PLOTS



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
<input checked="" type="checkbox"/>	Signal Analyzer (3 Hz ~ 50 GHz)	N9030A	Keysight	MY53311083	2021-06-07	HCT America	Note 2(c)
<input checked="" type="checkbox"/>	Attenuator (20dB) (DC ~ 18 GHz)	4779-20	Narda	6710	2021-05-10	HCT America	Note 2(c)
<input checked="" type="checkbox"/>	DC Power Supply	6030A	HP	1350582	2021-01-22	HCT America	Note 2(c)

Note(s) :

- 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).
- Calibration Method :
 - 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.
 - 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.
 - 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).
 - 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.

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