



Industrial Internet Innovation Center (Shanghai) Co.,Ltd.

SRD TEST REPORT

PRODUCT	Tedee Keypad PRO
BRAND	Tedee
MODEL	TKV2.0
APPLICANT	Tedee Sp. z o.o.
FCC ID	2BCK5TKV20
IC	31583-TKV20
ISSUE DATE	November 28, 2024
STANDARD(S)	FCC Part15C, RSS-Gen Issue 5, RSS-247 Issue 3

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1. Summary of Test Report

1.1 Test Standard(s)

No.	Test Standard	Title	Version
1	FCC Part15C	FCC CFR 47, Part 15, Subpart C: 15.205 Restricted bands of operation; 15.209 Radiated emission limits, general requirements; 15.247 Operation within the bands 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz.	--
2	RSS-Gen Issue 5	General Requirements for Compliance of Radio Apparatus	2021
3	RSS-247 Issue 3	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices	2023

1.2 Reference Document(s)

No.	Test Standard	Title	Version
1	ANSI C63.10	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices	2013
2	KDB 558074 D01 15.247 Meas Guidance v05r02	Guidance for Performing Compliance Measurements on Frequency Hopping Spread Spectrum systems (DSS) Operating Under §15.247	--

Note: KDB 558074 D01 15.247 Meas Guidance v05r02 is not A2LA certified.

1.3 Summary of Test Results

No.	Measurement Items	FCC Rules	IC Rules	Verdict
1	Maximum Peak Output Power	15.247(b)	RSS-247 5.4	Pass
2	Peak Power Spectral Density	15.247(e)	RSS-247 5.2	Pass
3	6dB Occupied Bandwidth	15.247(a)	RSS-247 5.2	Pass
4	99% Occupied Bandwidth	N/A	RSS-GEN 6.7	Pass
5	Band Edges Compliance	15.247(d)	RSS-247 5.5	Pass
6	Transmitter Spurious Emission-Conducted	15.247(d)	RSS-247 5.5	Pass
7	Transmitter Spurious Emission-Radiated	15.247/15.205/15.209	RSS-GEN 8.9, 8.10	Pass
8	AC Powerline Conducted Emission	15.207	RSS-GEN 8.8	N/A
9	Antenna requirement	15.203/15.247(c)	RSS Gen 6.8, RSS-247 5.4	Pass ^{Note 2}

Note 1:

The TKV2.0 manufactured by Tedee Sp. z o.o. is a new product for testing.

Industrial Internet Innovation Center (Shanghai) Co., Ltd. only performed test cases which identified with Pass/Fail/Inc result in section 1.3.

Industrial Internet Innovation Center (Shanghai) Co., Ltd. has verified that the compliance of the tested device specified in section 4 of this test report is successfully evaluated according to the procedure and

test methods as defined in type certification requirement listed in section 1 of this test report.

Note 2:

Bluetooth used a internal PCB antenna with max Gain 2 dBi that complied with 15.203 Requirements.

Note:

a. All the test data for each data were verified, but only the worst case was reported.

1.4 Data Provided by Applicant

No.	Item(s)	Data
1	Antenna gain of EUT	2 dBi

Note: The data of antenna gain is provided by the Antenna specification may affect the validity of the test results in this report, and the impact and consequences of this shall be undertaken by the customer.

2. General Information of The Laboratory

2.1 Testing Laboratory

Lab Name	Industrial Internet Innovation Center (Shanghai) Co.,Ltd.
Address	Building 4, No. 766, Jingang Road, Pudong, Shanghai, China
Telephone	021-68866880
FCC Registration No.	708870
FCC Designation No.	CN1364
IC Designation No.	10766A
CAB identifier	CN0067

2.2 Laboratory Environmental Requirements

Temperature	15°C~35°C
Relative Humidity	25%RH~75%RH
Atmospheric Pressure	86kPa~106kPa

2.3 Project Information

Project Manager	Zhang heng
Test Date	September 19, 2024 to November 17, 2024

3. General Information of The Customer

3.1 Applicant

Company	Tedee Sp. z o.o.
Address	Karola Bohdanowicza 21/57 Street
Telephone	+48 519 176 611

3.2 Manufacturer

Company	Tedee Sp. z o.o.
Address	Karola Bohdanowicza 21/57 Street
Telephone	+48 519 176 611

4. General Information of The Product

4.1 Product Description for Equipment under Test (EUT)

Product Name	Tedee Keypad PRO
Model name	TKV2.0
Date of Receipt	S06aa/S08aa: September 19, 2024 S12aa/S13aa: October 23, 2024
EUT ID*	S06aa/S08aa/S12aa/S13aa
SN/IMEI	NA
Supported Radio Technology and Bands	BLE
Hardware Version	P3
Software Version	V2.0
FCC ID	2BCK5TKV20
IC	31583-TKV20
NOTE1: EUT ID is the internal identification code of the laboratory. NOTE2: Samples in the test report are provided by the customer. The test results are only applicable to the samples received by the laboratory.	

4.2 Internal Identification of AE used during the test

AE ID*	Description	Model	SN/Remark
AE01	RF Cable	N/A	N/A
NOTE: *AE ID is the internal identification code of the laboratory.			

4.3 Additional Information

BLE Frequency	2402MHz-2480MHz
BLE Channel	Ch0-39
BLE Modulation	GFSK

Test frequency list:

BLE_1M	Channel	0	19	39
	Freq. (MHz)	2402	2440	2480

Note: This report is for BLE only.

Emissions Information:

TestMode	Frequency Min(MHz)	Frequency Max(MHz)	Max OutPut Power EIRP(dBm)	Max OutPut Power EIRP(W)	OBW (KHz)	Necessary Bandwidth & Emission Classification
BLE_1M	2402	2480	5.79	0.0038	1052	1M05F1D
BLE_2M	2402	2480	6.90	0.0049	2056	2M06F1D

5. Test Configuration Information

5.1 Laboratory Environmental Conditions

5.1.1 Permanent Facilities

Relative Humidity	Min. = 45 %, Max. = 55 %		
Atmospheric Pressure	101kPa		
Temperature	Normal	Minimum	Maximum
	25°C	-20°C	55°C
Working Voltage of EUT	Normal	Minimum	Maximum
	2.5V	2V	3V

5.2 Test Equipments Utilized

5.2.1 Conducted Test System

No.	Name	Model	S/N	SW Version	HW Version	Manuf acturer	Cal. Date	Cal. Interva l
1	Test Software	TS1120	10727	V3.2.22	N/A	Tonsce nd	N/A	N/A
2	Automatic control unit	JS0806-2	2218060623	N/A	N/A	Tonsce nd	2024-03-25	1 Year
3	Wireless communication comprehensive tester	CMW500	164865	V3.8.12	N/A	R&S	2024-07-25	1 Year
4	Spectrum Analyzer	FSQ40	200063	V4.75	N/A	R&S	2023-10-16 2024-9-29	1 Year
5	Analog Signal Generator	SMF	104770	V3.0.13.0-2.20.530.15.4	N/A	R&S	2024-07-25	1 Year
6	Vector Signal Generator	SMCV100B	103691	V5.00.122.24	N/A	R&S	2024-07-25	1 Year
7	Programmable Power Supply	Keithley 2303	4039070	N/A	N/A	Keithle y	2024-06-07	1 Year
8	Temperature box	B-TF-107C	BTF107C-201804107	N/A	N/A	Boyi	2024-06-07	1 Year

5.2.2 Radiated Emission Test System

No.	Name	Model	S/N	SW Version	HW Version	Manufacturer	Cal. Date	Cal. Interval
1	Universal Radio Communication Tester	CMU200	123126	V5.2.1	B12	R&S	2023-10-16 2024-10-09	1 Year
2	Universal Radio Communication Tester	CMW500	104178	V3.7.20	1206.06 00.00	R&S	2023-10-16 2024-10-09	1 Year
3	EMI Test Receiver	ESU40	100307	V5.1-24-3	01	R&S	2023-12-19	1 Year
4	TRILOG Broadband Antenna	VULB9163	01345	N/A	N/A	Schwarzbeck	2024-03-29	1 Year
5	Double-ridged Waveguide Antenna	ETS-3117	00135890	N/A	N/A	ETS	2024-03-16	1 Year
6	EMI Test Software	EMC32 V10.35.02	N/A	V10.35.02	N/A	R&S	N/A	N/A
7	Horn Antenna	3160-09	LM6321	N/A	N/A	R&S	2024-08-03	1 Year
8	Horn Antenna	3160-10	LM5942	N/A	N/A	R&S	2024-08-03	1 Year
9	Loop Antenna	AL-130R	121083	N/A	N/A	COMPOWER	2024-08-31	1 Year
10	Preamplifier	SCU08F1	8320024	N/A	N/A	R&S	2023-10-16 2024-10-09	1 Year
11	Preamplifier	SCU18	10155	N/A	N/A	R&S	2023-10-16 2024-10-09	1 Year
12	Preamplifier	SCU26	10025	N/A	N/A	R&S	2023-10-16 2024-10-09	1 Year
13	Preamplifier	SCU40	10020	N/A	N/A	R&S	2023-10-16 2024-10-09	1 Year
14	2-Line V-Network	ENV216	101380	N/A	N/A	R&S	2023-12-19	1 Year
15	EMI Test Software	EMC32 V10.35.02	N/A	N/A	N/A	R&S	N/A	N/A
16	Test Receiver	ESCI	101235	V5.1-24-3	0	R&S	2023-12-19	1 Year

17	Antenna Tower	TPMDC-LF	N/A	N/A	N/A	Top Precisi on	N/A	N/A
18	Antenna Tower	TPMDC- HF	N/A	N/A	N/A	Top Precisi on	N/A	N/A

5.2.3 Test Environment

Shielding Room1 (6.0 meters×3.0 meters×2.7 meters) did not exceed following limits along the conducted RF performance testing:

Temperature	Min. = 15 °C, Max. = 35 °C
Relative humidity	Min. = 20 %, Max. = 75 %
Shielding effectiveness	> 100 dB
Ground system resistance	< 0.5 Ω
Temperature	Min. = 15 °C, Max. = 35 °C

Control room did not exceed following limits along the EMC testing:

Temperature	Min. = 15 °C, Max. = 35 °C
Relative humidity	Min. = 30 %, Max. = 60 %
Shielding effectiveness	> 100 dB
Electrical insulation	> 10 kΩ
Ground system resistance	< 0.5 Ω

Fully-anechoic chamber1 (9.8 meters×6.7 meters×6.7 meters) did not exceed following limits along the EMC testing:

Temperature	Min. = 15 °C, Max. = 35 °C
Relative humidity	Min. = 25 %, Max. = 75 %
Shielding effectiveness	> 100 dB
Electrical insulation	> 10 kΩ
Ground system resistance	< 0.5 Ω
VSWR	Between 0 and 6 dB, from 1GHz to 18GHz
Site Attenuation Deviation	Between -4 and 4 dB, 30MHz to 1GHz

5.3 Measurement Uncertainty

Measurement Uncertainty of Conduction test

Item(s)	Frequency range	Confidence Level	Uncertainty
DTS Bandwidth	2400–2483.5MHz	95%	±1.9%
Maximum Conducted Output Power	2400–2483.5MHz	95%	± 1.18 dB
Maximum Power Spectral Density Level	2400–2483.5MHz	95%	±0.98 dB
Band-edge Compliance	2400–2483.5MHz	95%	±1.21dB
Unwanted Emissions In Non-restricted Freq Bands	9kHz-7GHz	95%	9kHz-7GHz:±1.21dB

	7GHz-40GHz	95%	7GHz-40GHz:±3.31dB
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Measurement Uncertainty of Radiation test

Measurement Items	Uncertainty(dB)
Radiated Emission 30MHz-1000MHz	±5.10
Radiated Emission 1000MHz-18000MHz	±5.66
Radiated Emission 18000MHz-40000MHz	±5.22
AC Powerline Conducted Emission	±4.38

Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

6. Test Results

6.1 Peak Output Power-Conducted

6.1.1 Measurement Limit

Standard	Conducted Limit(dBm)	EIRP Limit(dBm)
FCC 47 Part 15.247(b)(3)	<30	N/A
RSS-247 5.4(d)	<30	<36

6.1.2 Test Condition

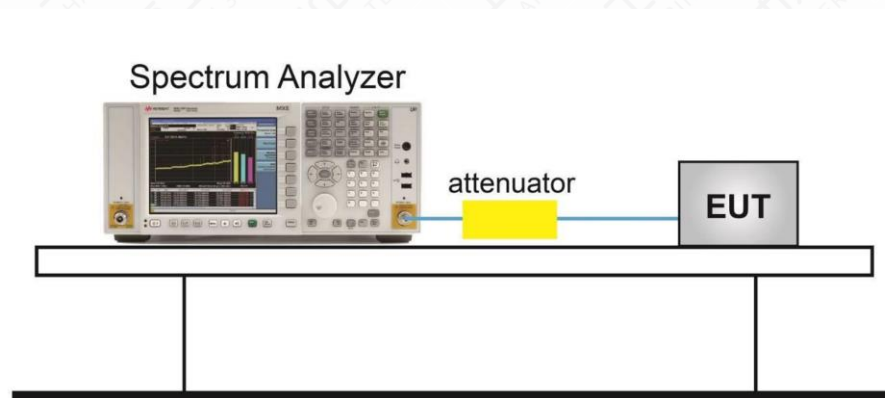
DTS procedure	RBW	VBW	Span	Sweeptime
BT-LE	3MHz	10MHz	9MHz	Auto

6.1.3 Test Procedure

The measurement is according to ANSI C63.10 clause 11.9.1

- Set the $RBW \geq$ DTS bandwidth.
- Set $VBW \geq [3 \times RBW]$.
- Set span $\geq [3 \times RBW]$.
- Sweep time = auto couple.
- Detector = peak.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use peak marker function to determine the peak amplitude level.

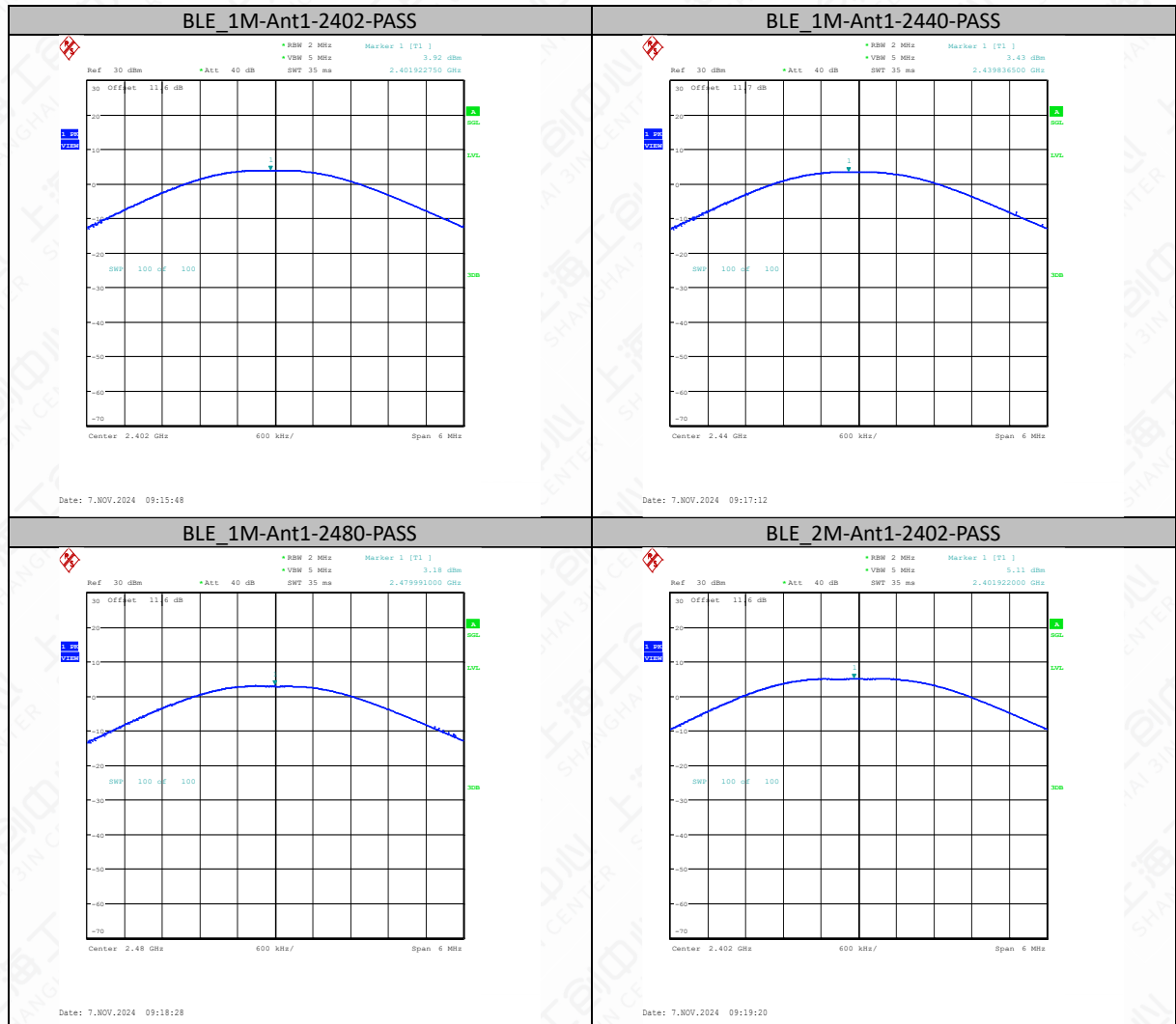
6.1.4 Test setup

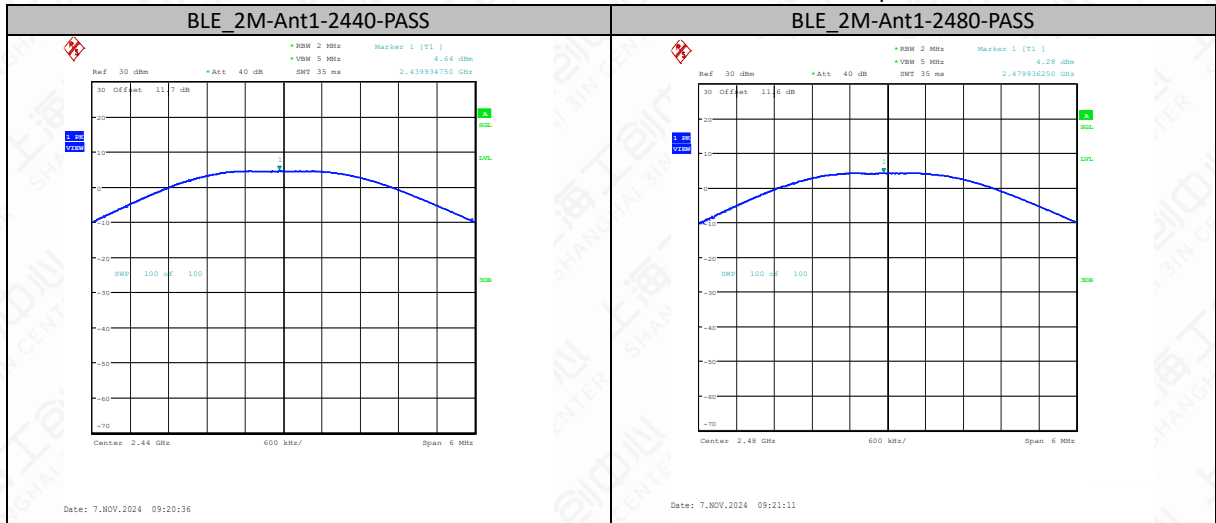


6.1.5 Measurement Results

TestMode	Antenna	Frequency[MHz]	Conducted Power[dBm]	Conducted Limit[dBm]	EIRP[dBm]	EIRP Limit[dBm]	Verdict
BLE_1M	Ant1	2402	3.92	≤30	5.92	≤36	PASS
BLE_1M	Ant1	2440	3.43	≤30	5.43	≤36	PASS
BLE_1M	Ant1	2480	3.18	≤30	5.18	≤36	PASS
BLE_2M	Ant1	2402	5.11	≤30	7.11	≤36	PASS
BLE_2M	Ant1	2440	4.64	≤30	6.64	≤36	PASS
BLE_2M	Ant1	2480	4.28	≤30	6.28	≤36	PASS

Test Graphs





6.2 99% Occupied Bandwidth

6.2.1 Measurement Limit

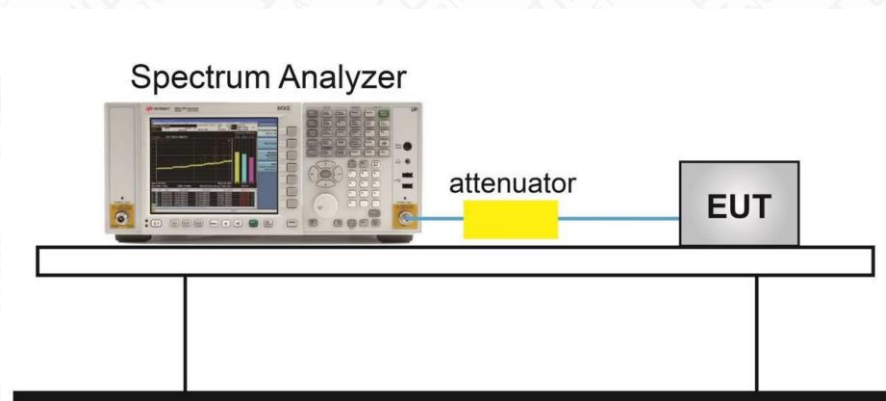
Standard	Limit
15.247(a)	N/A
RSS-Gen 6.7	N/A

6.2.2 Test procedures

The measurement is according to ANSI C63.10 clause 6.9.3.

1. The output power of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Enable EUT transmitter maximum power continuously.
3. Set RBW shall be in the range of 1% to 5% of the OBW.
4. Set the VBW $\geq [3 \times \text{RBW}]$.
5. Detector = peak.
6. Trace mode = max hold.
7. Sweep = auto couple.
8. Allow the trace to stabilize.
9. The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission.

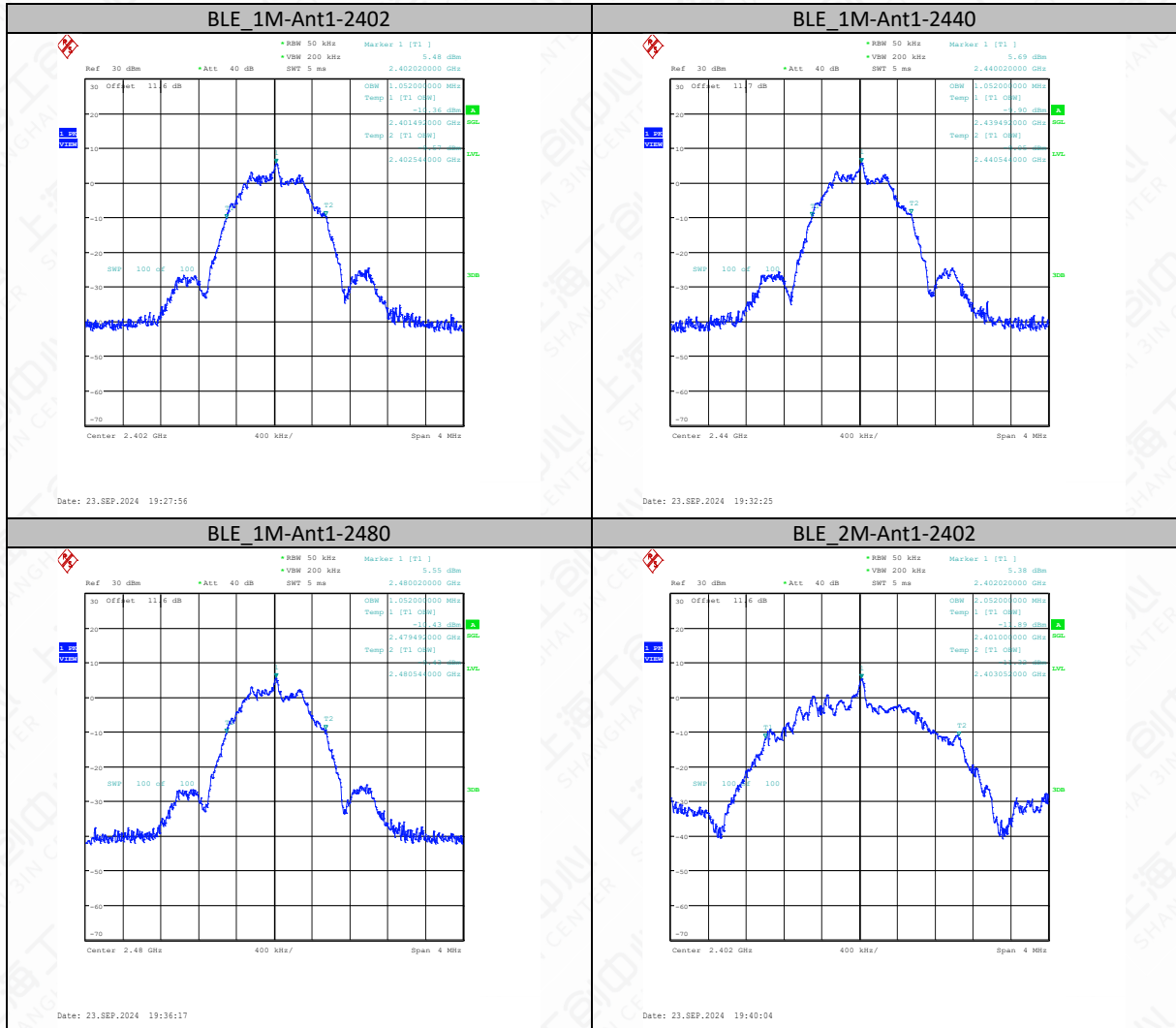
6.2.3 Test setup

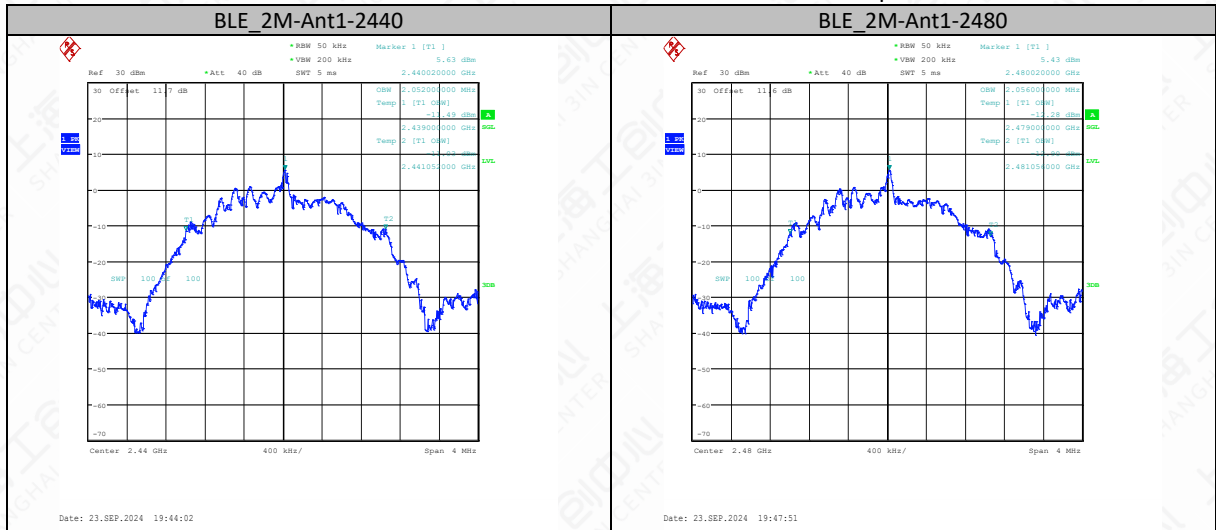


6.2.4 Measurement Result

TestMode	Antenna	Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	1.052	2401.4920	2402.5440	---	---
BLE_1M	Ant1	2440	1.052	2439.4920	2440.5440	---	---
BLE_1M	Ant1	2480	1.052	2479.4920	2480.5440	---	---
BLE_2M	Ant1	2402	2.052	2401.0000	2403.0520	---	---
BLE_2M	Ant1	2440	2.052	2439.0000	2441.0520	---	---
BLE_2M	Ant1	2480	2.056	2479.0000	2481.0560	---	---

Test graphs





6.3 Peak Power Spectral Density

6.3.1 Measurement Limit

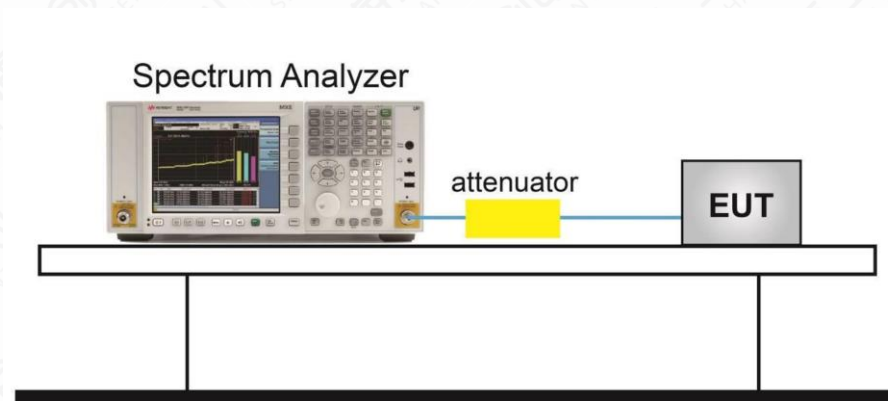
Standard	Limit
FCC 47 Part 15.247(e)	$\leq 8\text{dBm}/3\text{ kHz}$
RSS-247 5.2(b)	$\leq 8\text{dBm}/3\text{ kHz}$

6.3.2 Test procedures

The measurement is according to ANSI C63.10 clause 11.10.

1. The output power of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Enable EUT transmitter maximum power continuously.
3. Set analyzer center frequency to DTS channel center frequency.
4. Set the span to 1.5 times the DTS bandwidth.
5. Set the RBW to $3\text{ kHz} \leq \text{RBW} \leq 100\text{ kHz}$.
6. Set the VBW $\geq [3 \times \text{RBW}]$.
7. Detector = peak.
8. Sweep time = auto couple.
9. Trace mode = max hold.
10. Allow trace to fully stabilize.
11. Use the peak marker function to determine the maximum amplitude level within the RBW.
12. If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.

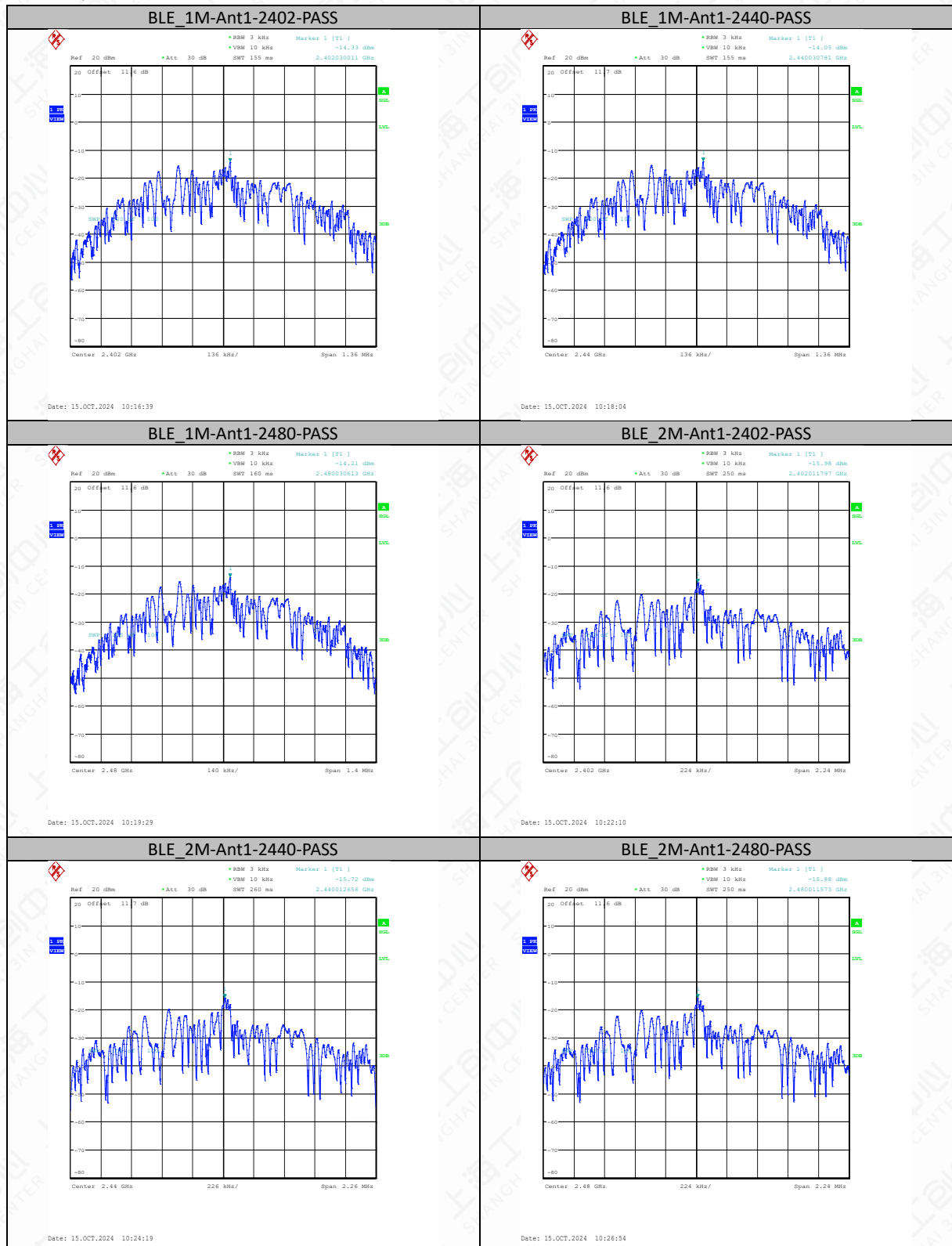
6.3.3 Test Setup



6.3.4 Measurement Results

TestMode	Antenna	Frequency[MHz]	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-14.33	≤ 8.00	PASS
BLE_1M	Ant1	2440	-14.05	≤ 8.00	PASS
BLE_1M	Ant1	2480	-14.21	≤ 8.00	PASS
BLE_2M	Ant1	2402	-15.98	≤ 8.00	PASS
BLE_2M	Ant1	2440	-15.72	≤ 8.00	PASS
BLE_2M	Ant1	2480	-15.88	≤ 8.00	PASS

Test Graphs



6.4 6dB Bandwidth

6.4.1 Measurement Limit

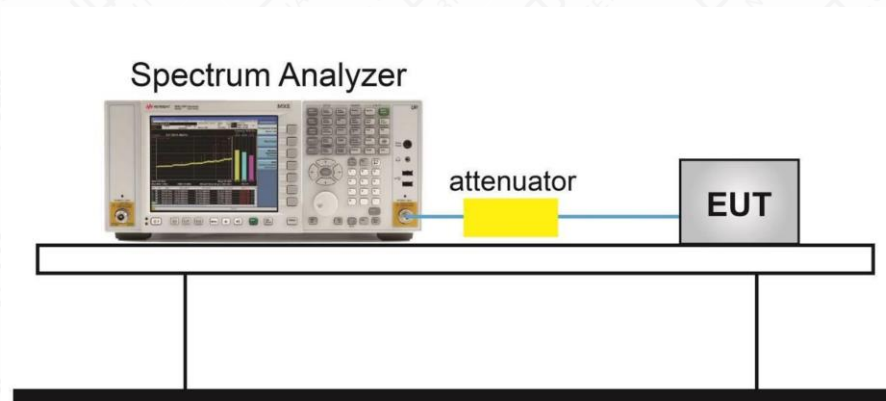
Standard	Limit
FCC 47 Part 15.247 (a) (2)	$\geq 500\text{kHz}$
RSS-247 5.2(a)	$\geq 500\text{kHz}$

6.4.2 Test procedures

The measurement is according to ANSI C63.10 clause 11.8.

1. The output power of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Enable EUT transmitter maximum power continuously.
3. Set RBW = 100 kHz.
4. Set the VBW $\geq [3 \times \text{RBW}]$.
5. Detector = peak.
6. Trace mode = max hold.
7. Sweep = auto couple.
8. Allow the trace to stabilize.
9. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

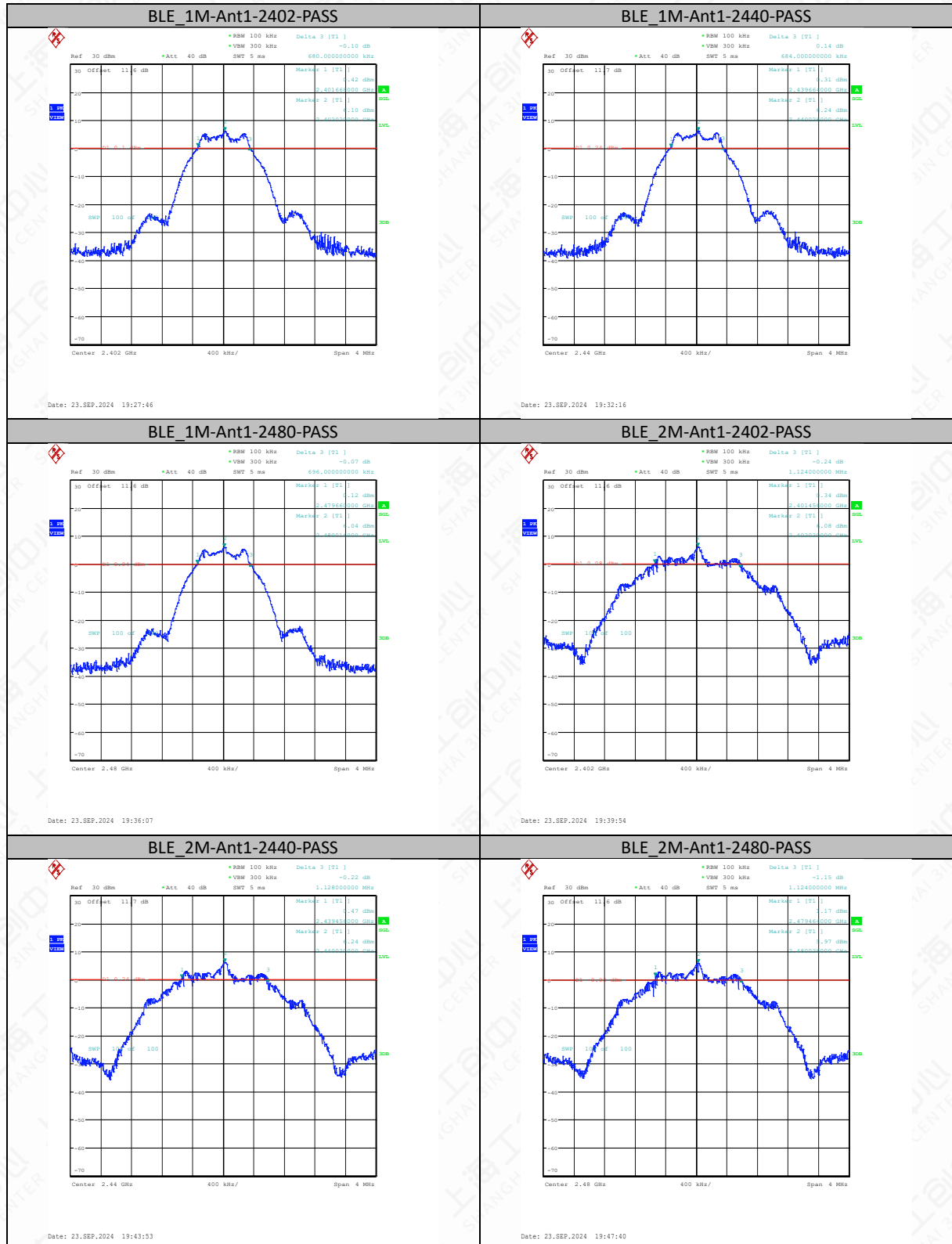
6.4.3 Test Setup



6.4.4 Measurement Result

TestMode	Antenna	Frequency[MHz]	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	0.68	2401.67	2402.35	0.5	PASS
BLE_1M	Ant1	2440	0.68	2439.66	2440.35	0.5	PASS
BLE_1M	Ant1	2480	0.70	2479.66	2480.36	0.5	PASS
BLE_2M	Ant1	2402	1.12	2401.46	2402.58	0.5	PASS
BLE_2M	Ant1	2440	1.13	2439.46	2440.58	0.5	PASS
BLE_2M	Ant1	2480	1.12	2479.46	2480.59	0.5	PASS

Test Graphs



6.5 Frequency Band Edges-Conducted

6.5.1 Measurement Limit

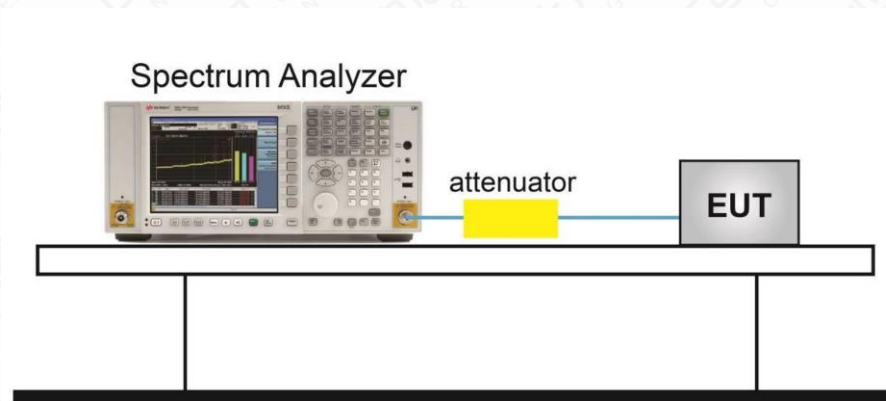
Standard	Limit(dBc)
FCC 47 Part 15.247(d)	>20
RSS-247 5.5	>20

6.5.2 Test procedures

The measurement is according to ANSI C63.10 clause 11.13.2

- 1) Span: Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products that fall outside of the authorized band of operation.
- 2) Reference level: As required to keep the signal from exceeding the maximum instrument input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.5.2.
- 3) Attenuation: Auto (at least 10 dB preferred).
- 4) Sweep time: Coupled.
- 5) Resolution bandwidth: 100 kHz.6) Video bandwidth: 300 kHz.7) Detector: Peak.8) Trace: Max hold.

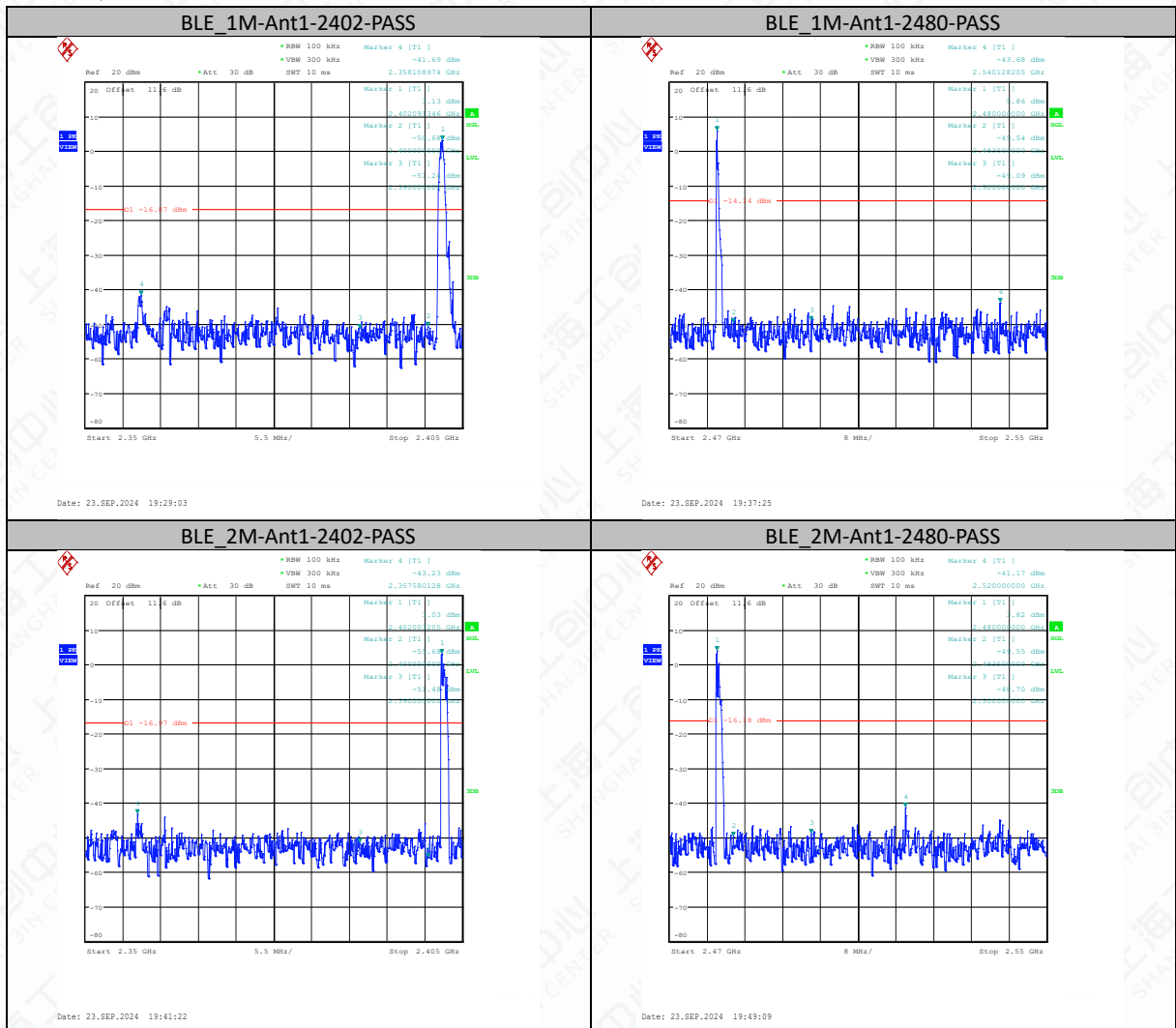
6.5.3 Test Setup



6.5.4 Measurement Result

TestMode	Antenna	ChName	Frequency[MHz]	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	Low	2402	3.13	-41.69	≤-16.87	PASS
BLE_1M	Ant1	High	2480	5.86	-43.68	≤-14.14	PASS
BLE_2M	Ant1	Low	2402	3.03	-43.23	≤-16.97	PASS
BLE_2M	Ant1	High	2480	3.82	-41.17	≤-16.18	PASS

Test Graphs



6.6 Conducted Emission

6.6.1 Measurement Limit

Standard	Limit(dBc)
FCC 47 Part 15.247(d)	20dB below peak output power in 100KHz bandwidth
RSS-247 5.5	20dB below peak output power in 100KHz bandwidth

6.6.2 Test procedures

This measurement is according to ANSI C63.10 clause 11.11.

1. The output power of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Enable EUT transmitter maximum power continuously.

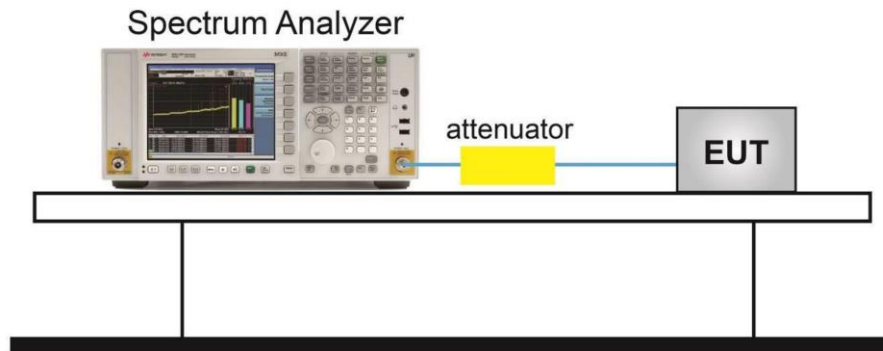
Reference level measurement

3. Set instrument center frequency to DTS channel center frequency.
4. Set the span to ≥ 1.5 times the DTS bandwidth.
5. Set the RBW = 100 kHz.
6. Set the VBW $\geq [3 \times \text{RBW}]$.
7. Detector = peak.
8. Sweep time = auto couple.
9. Trace mode = max hold.
10. Allow trace to fully stabilize.
11. Use the peak marker function to determine the maximum PSD level.

Emission level measurement

1. Set the center frequency and span to encompass frequency range to be measured.
2. Set the RBW = 100 kHz.
3. Set the VBW $\geq [3 \times \text{RBW}]$.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum amplitude level.

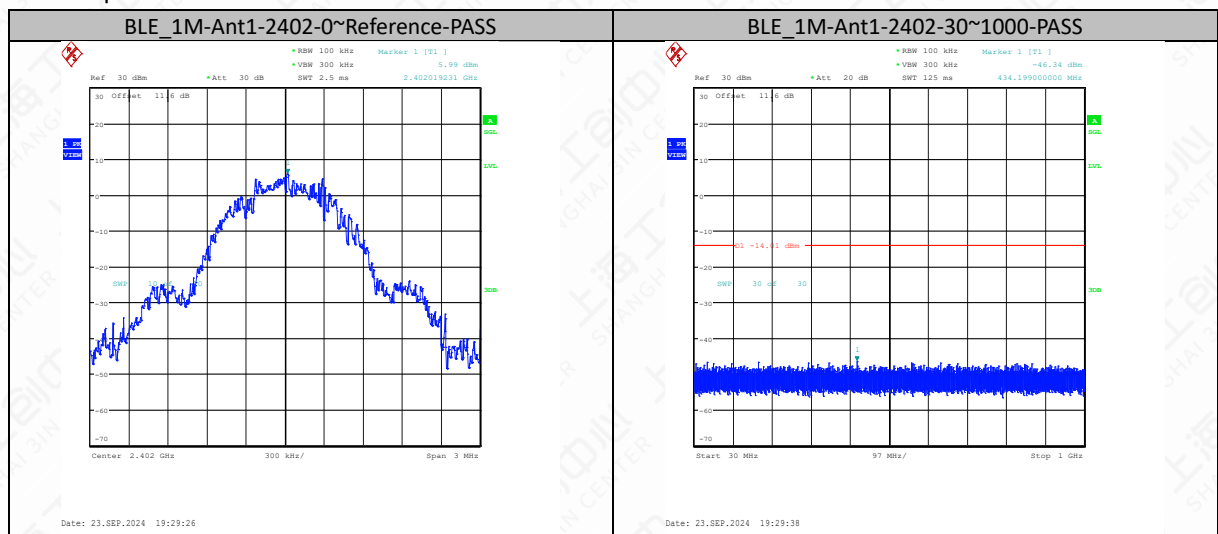
6.6.3 Test Setup

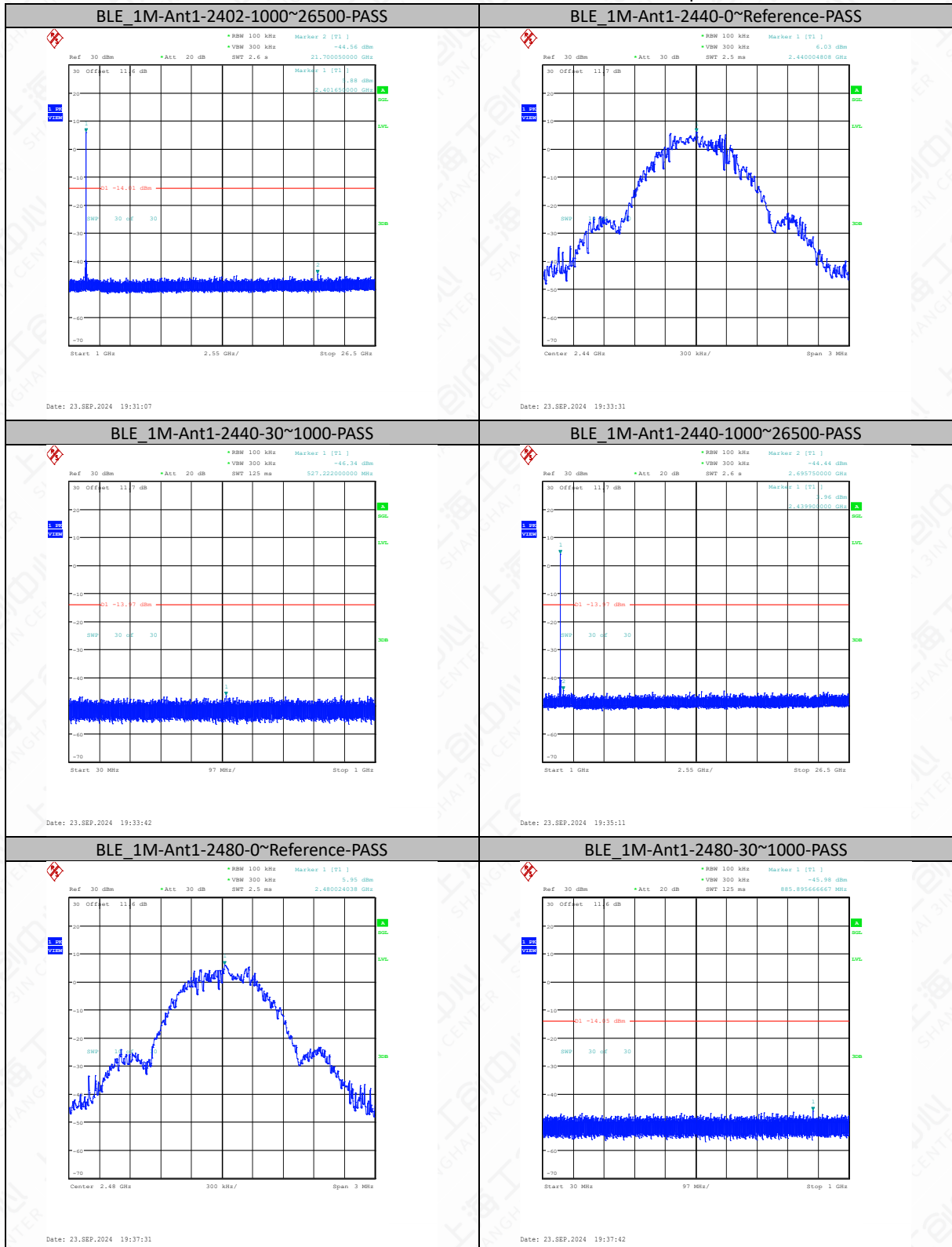


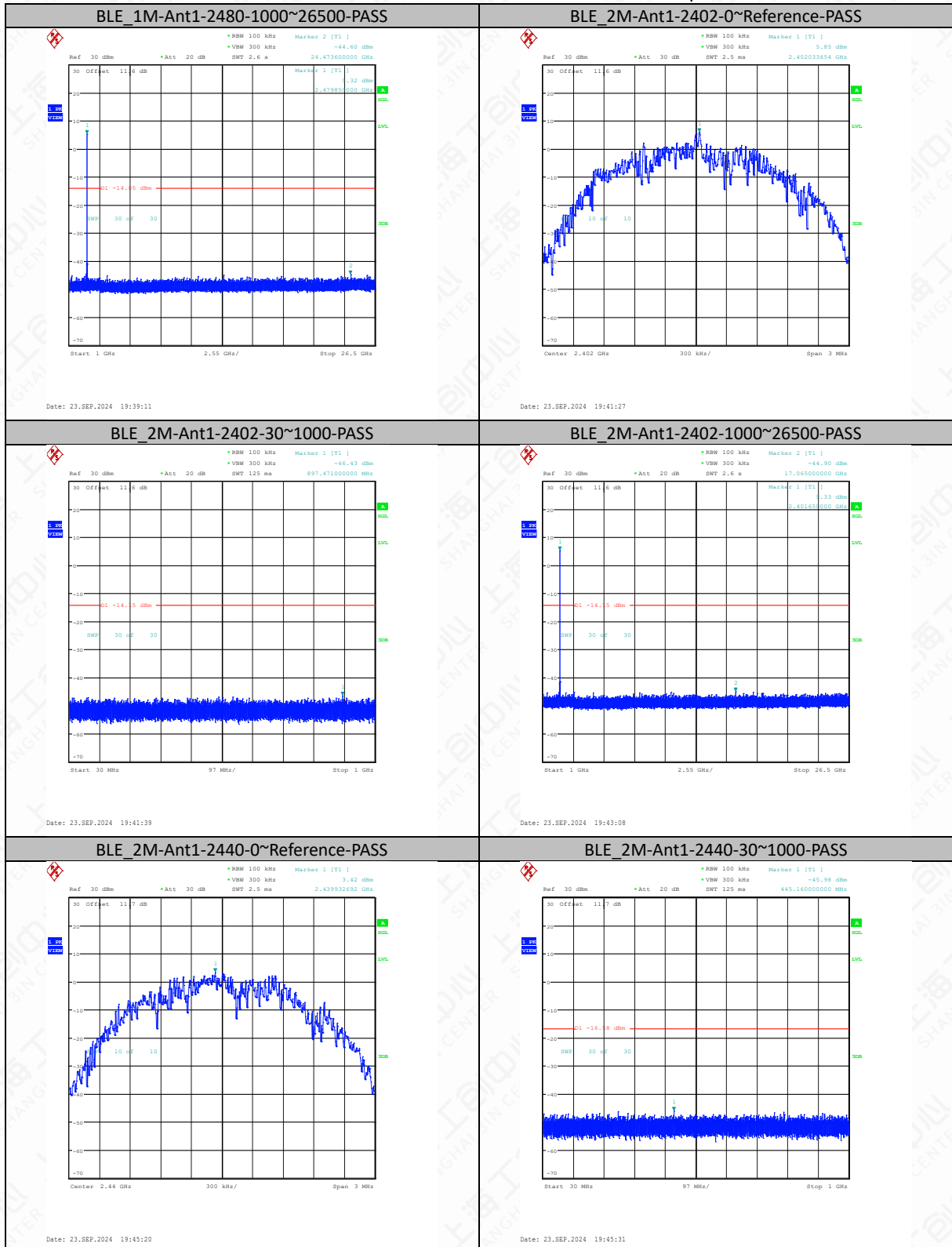
6.6.4 Measurement Result

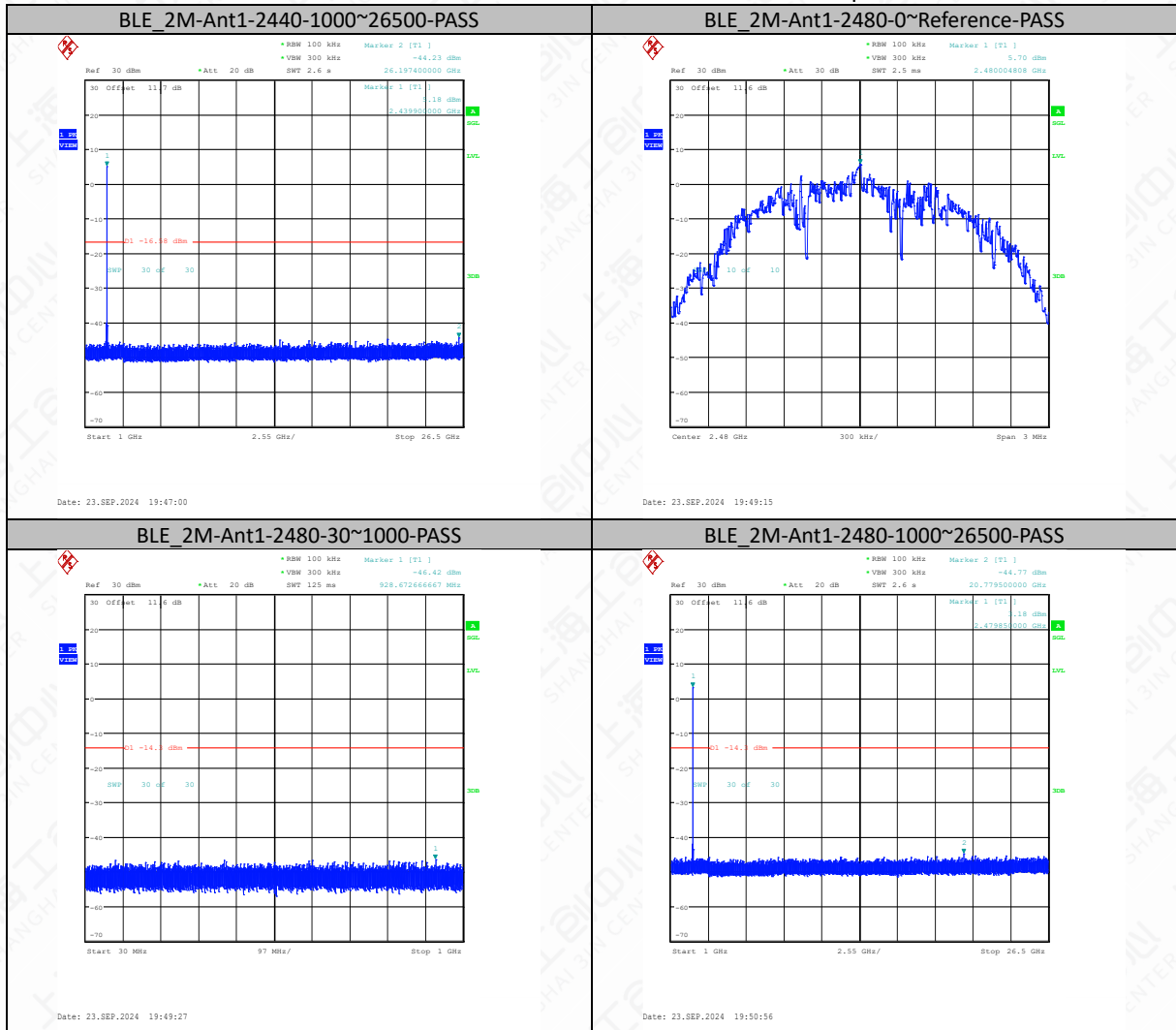
TestMode	Antenna	Frequency[MHz]	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	0~Reference	5.99	5.99	---	PASS
BLE_1M	Ant1	2402	30~1000	5.99	-46.34	≤-14.01	PASS
BLE_1M	Ant1	2402	1000~26500	5.99	-44.56	≤-14.01	PASS
BLE_1M	Ant1	2440	0~Reference	6.03	6.03	---	PASS
BLE_1M	Ant1	2440	30~1000	6.03	-46.34	≤-13.97	PASS
BLE_1M	Ant1	2440	1000~26500	6.03	-44.44	≤-13.97	PASS
BLE_1M	Ant1	2480	0~Reference	5.95	5.95	---	PASS
BLE_1M	Ant1	2480	30~1000	5.95	-45.98	≤-14.05	PASS
BLE_1M	Ant1	2480	1000~26500	5.95	-44.6	≤-14.05	PASS
BLE_2M	Ant1	2402	0~Reference	5.85	5.85	---	PASS
BLE_2M	Ant1	2402	30~1000	5.85	-46.43	≤-14.15	PASS
BLE_2M	Ant1	2402	1000~26500	5.85	-44.9	≤-14.15	PASS
BLE_2M	Ant1	2440	0~Reference	3.42	3.42	---	PASS
BLE_2M	Ant1	2440	30~1000	3.42	-45.98	≤-16.58	PASS
BLE_2M	Ant1	2440	1000~26500	3.42	-44.23	≤-16.58	PASS
BLE_2M	Ant1	2480	0~Reference	5.70	5.70	---	PASS
BLE_2M	Ant1	2480	30~1000	5.70	-46.42	≤-14.3	PASS
BLE_2M	Ant1	2480	1000~26500	5.70	-44.77	≤-14.3	PASS

Test Graphs









6.7 Radiated Emission

6.7.1 Measurement Limit

According to the FCC 15.205&15.209/RSS-Gen section 8.9&1.0

Limit in restricted band

Frequency of emission (MHz)	Field strength (mV/m)	Field strength (dBuV/m)
0.009~0.49	2400/F (kHz)	129-94
0.49~1.705	24000/F (kHz)	74-63
1.705~30	30	70
30~88	100	40
88~216	150	43.5
216~960	200	46
Above 960	500	54

6.7.2 Test Method

Portable, small, lightweight, or modular devices that may be handheld, worn on the body, or placed on a table during operation shall be positioned on a non-conducting platform, the top of which is 80 cm above the reference ground plane. The preferred area occupied by the EUT arrangement is 1 m by 1.5 m, but it may be larger or smaller to accommodate various sized EUTs. For testing purposes, ceiling- and wall-mounted devices also shall be positioned on a tabletop (see also ANSI C63.10-2013 section 6.3.4 and 6.3.5). In making any tests involving handheld, body-worn, or ceiling-mounted equipment, it is essential to recognize that the measured levels may be dependent on the orientation (attitude) of the three orthogonal axes of the EUT. Thus, exploratory tests as specified in 8.3.1 shall be carried out for various axes orientations to determine the attitude having maximum or near-maximum emission level.

The EUT was placed on a non-conductive table. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and the EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.

Test Settings – Below 1GHz (Quasi-Peak Field Strength Measurements)

1. Set the center frequency and span to encompass frequency range to be measured.
2. Set the RBW = 100 kHz.
3. Set the VBW = 300 kHz.
4. Detector = quasi-peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Trace was allowed to stabilize.

Test Settings – Above 1GHz (Peak Field Strength Measurements)

1. Set the center frequency and span to encompass frequency range to be measured.
2. Set the RBW = 1MHz.
3. Set the VBW = 3MHz.
4. Detector = peak
5. Trace mode = max hold

6. Sweep time = auto
7. Trace (RMS) averaging was performed over at least 100 traces.

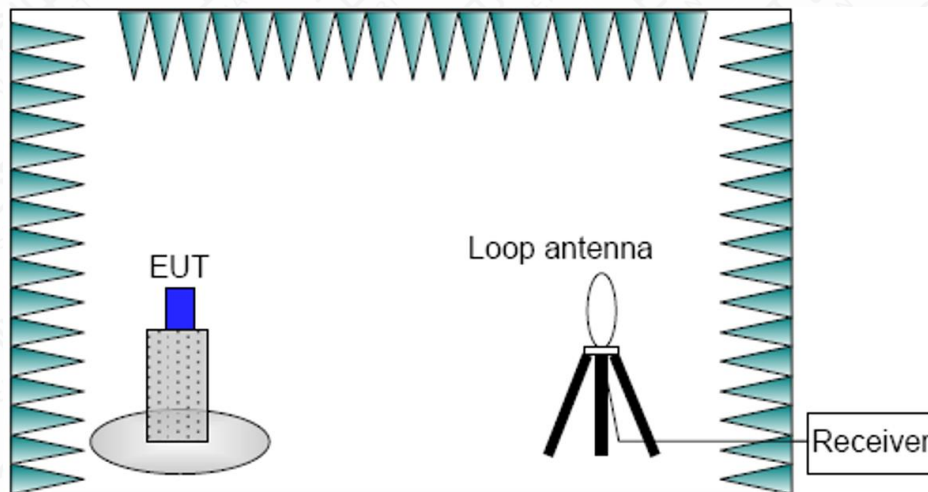
Test Settings – Above 1GHz (Average Field Strength Measurements)

1. Set the center frequency and span to encompass frequency range to be measured.
2. Set the RBW = 1MHz.
3. Set the VBW = 3MHz.
4. Detector = power average (RMS).
5. Number of measurement points = 1001 (Number of points must be $\geq 2 \times \text{span} \backslash \backslash \text{RBW}$)
6. Sweep time = auto
7. Trace (RMS) averaging was performed over at least 100 traces.

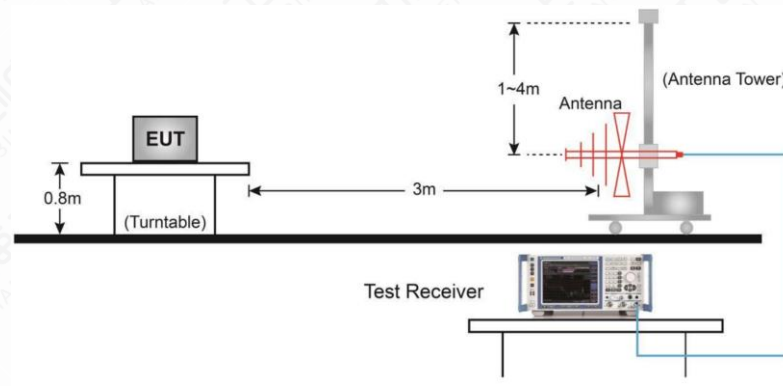
Frequency of emission (MHz)	RBW/VBW	Sweep Time (s)
0.009~30	9KHz/30KHz	Auto
30~1000	100KHz/300KHz	5
1000~4000	1MHz/3MHz	15
4000~18000	1MHz/3MHz	40
18000~26500	1MHz/3MHz	20

6.7.3 Test Setup

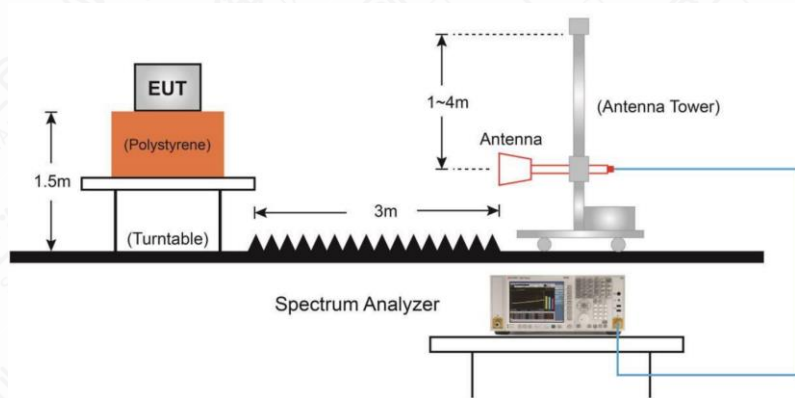
Below 30MHz Test Setup



Below 1GHz Test Setup



Above 1GHz Test Setup



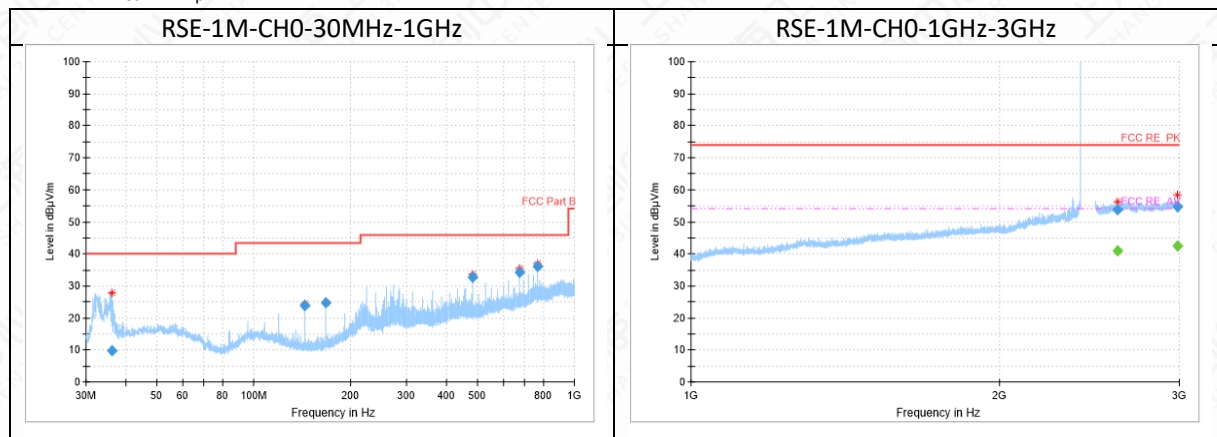
6.7.4 Measurement Results

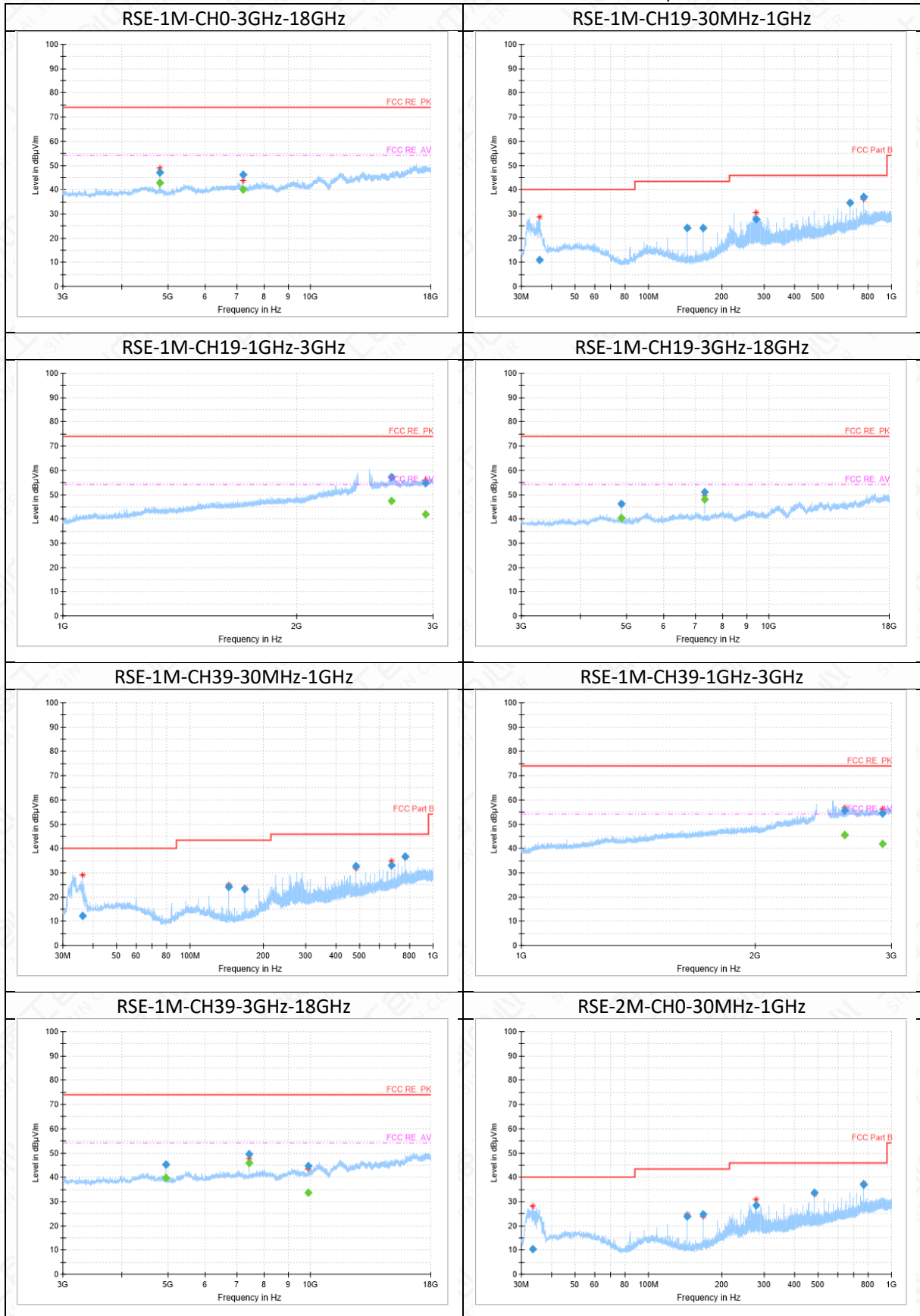
A “reference path loss” is established and AR_{pi} is the attenuation of “reference path loss”, and including the gain of receive antenna, the gain of the preamplifier, the cable loss.

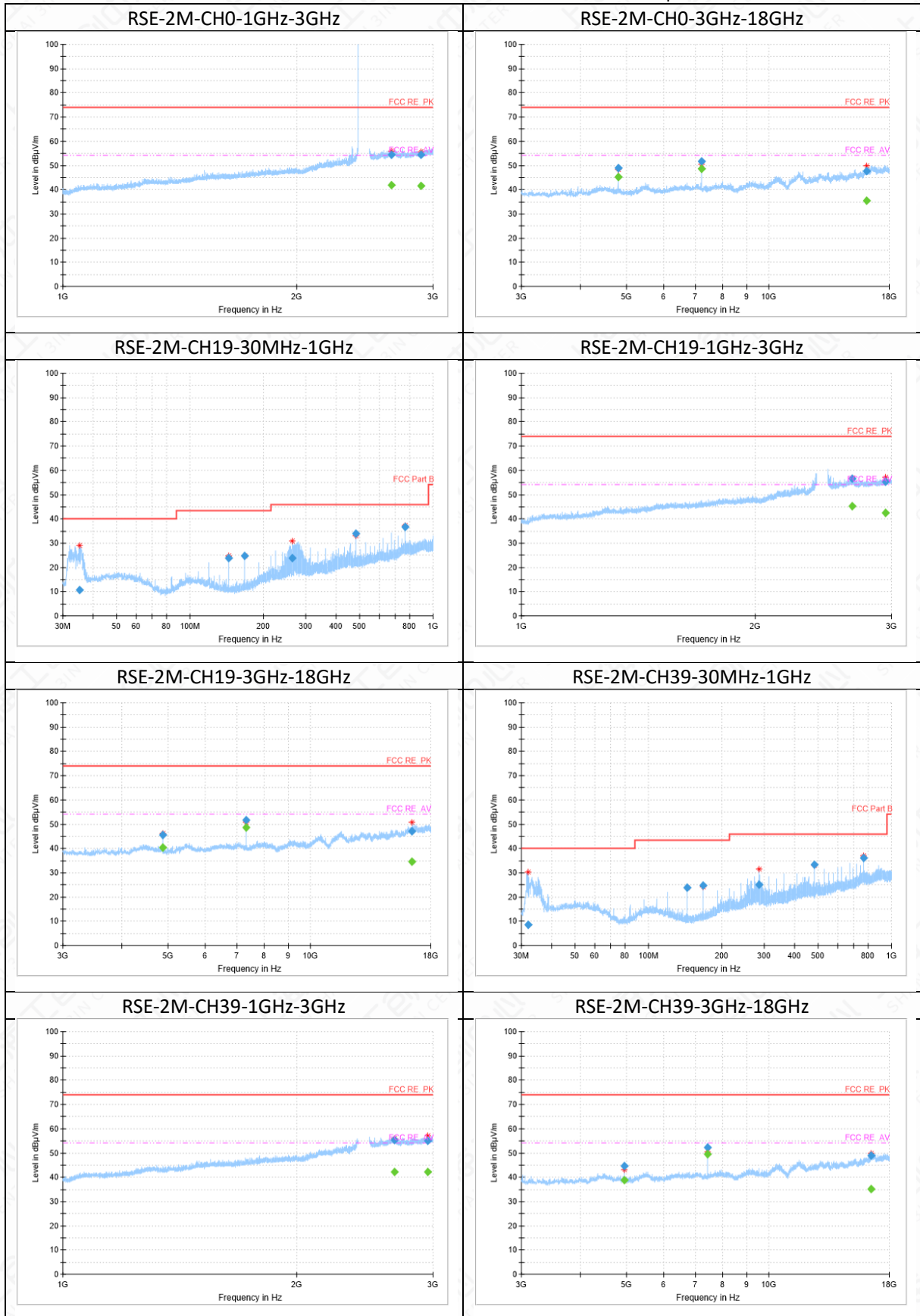
The measurement results are obtained as described below:

$AR_{pi} = \text{Cable loss} + \text{Antenna Factor} - \text{Preamplifier gain}$

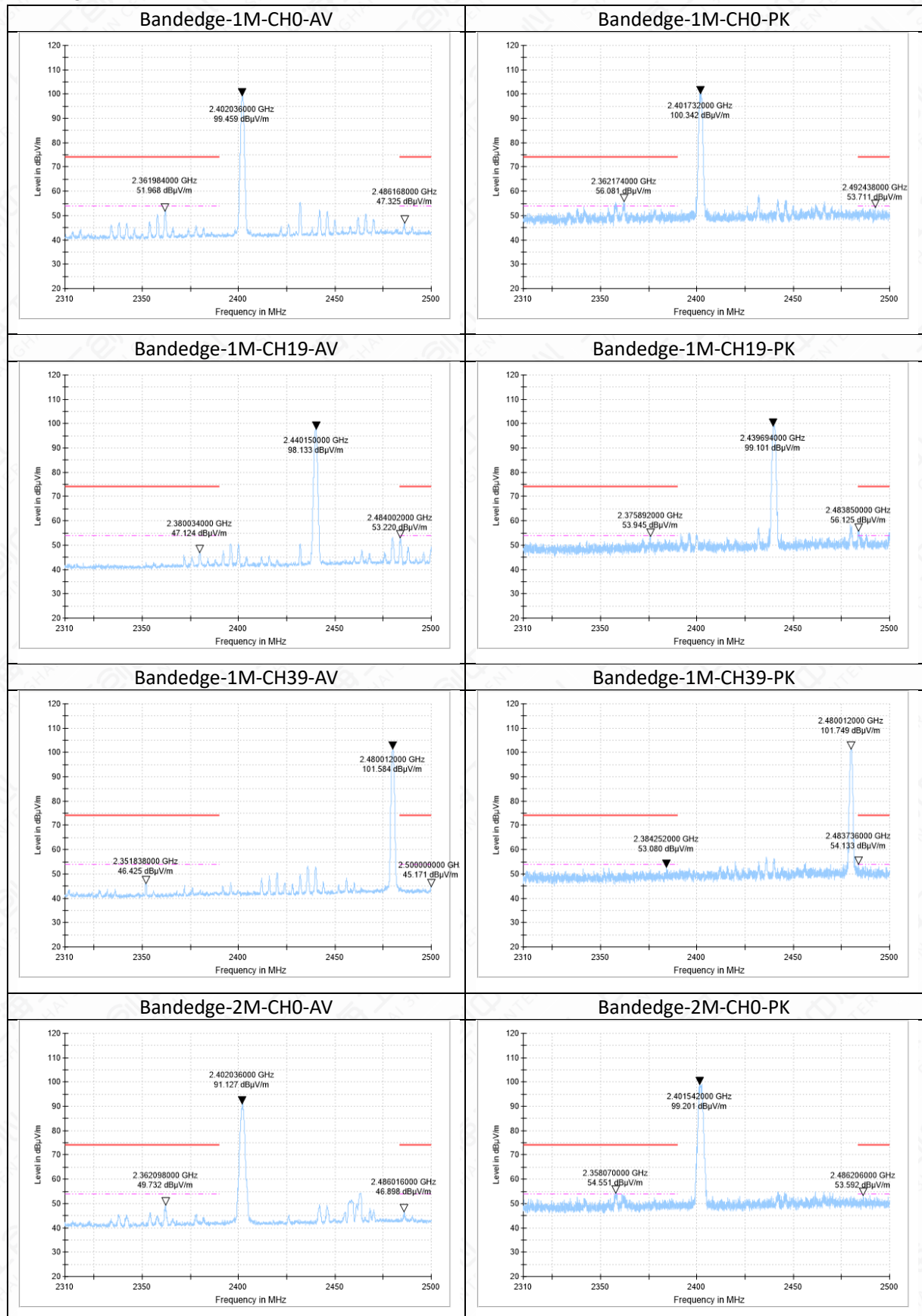
$\text{Result} = P_{\text{Mea}} + AR_{pi}$

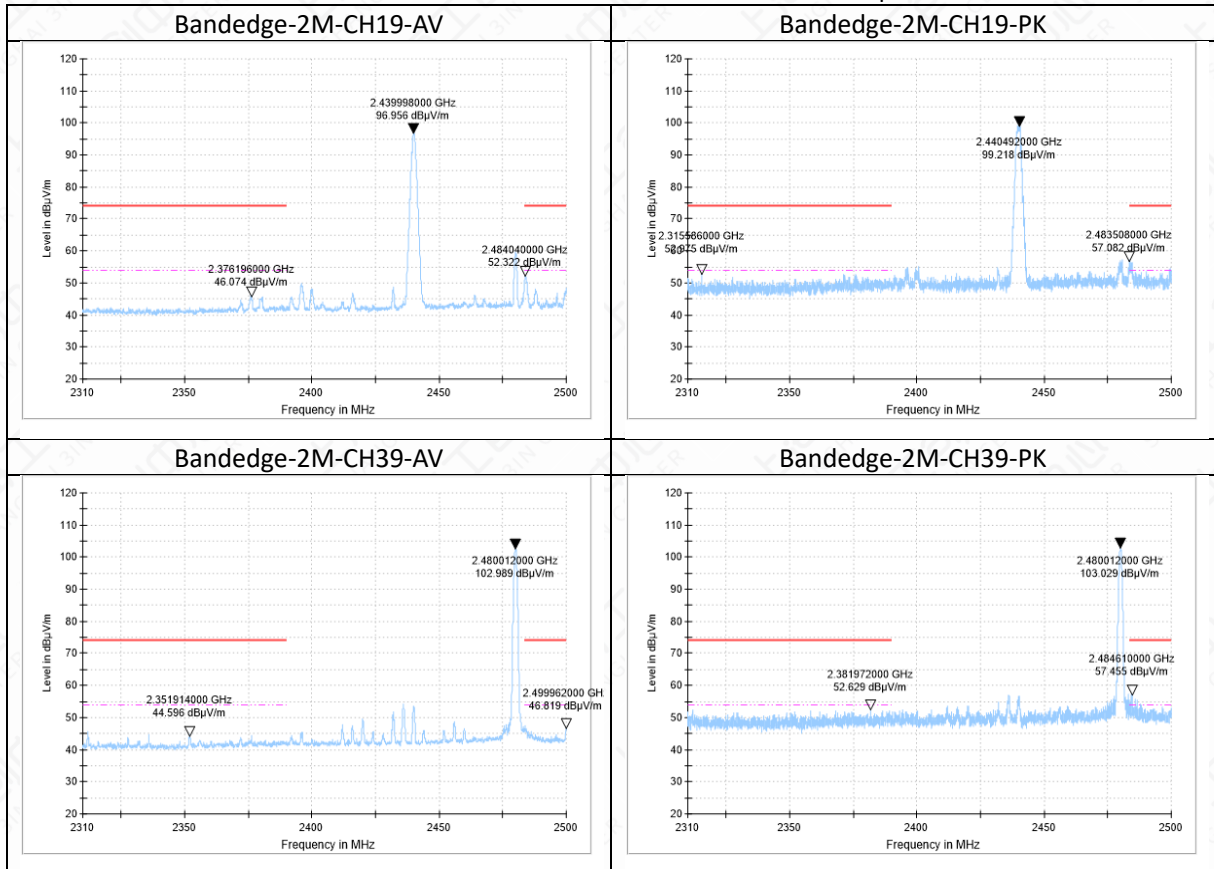






Bandedge





RSE-1M-CH0-30MHz-1GHz

Frequency (MHz)	QuasiPeak(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
36.1	9.8	-14	23.8	30.20	40.00	V
144.0	23.74	-17	40.74	19.76	43.50	H
168.0	24.9	-15	39.9	18.60	43.50	H
480.0	32.74	-6	38.74	13.26	46.00	H
672.0	34.37	-1	35.37	11.63	46.00	H
768.0	36.18	0	36.18	9.82	46.00	H

RSE-1M-CH0-1GHz-3GHz

Frequency (MHz)	MaxPeak(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
2610.8	53.96	17	36.96	20.04	74.00	V
2983.7	54.84	18	36.84	19.16	74.00	V

RSE-1M-CH0-1GHz-3GHz

Frequency (MHz)	Average(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
2610.8	41.09	17	24.09	12.91	54.00	V
2983.7	42.43	18	24.43	11.57	54.00	V

RSE-1M-CH0-3GHz-18GHz

Frequency (MHz)	MaxPeak(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
4804.2	47.2	-4	51.2	26.80	74.00	H
7206.1	46.28	-2	48.28	27.72	74.00	H

RSE-1M-CH0-3GHz-18GHz

Frequency (MHz)	Average(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
4804.2	42.89	-4	46.89	11.11	54.00	H
7206.1	40.09	-2	42.09	13.91	54.00	H

RSE-1M-CH19-30MHz-1GHz

Frequency (MHz)	QuasiPeak(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
35.5	10.93	-14	24.93	29.07	40.00	V
144.0	24.08	-17	41.08	19.42	43.50	H
168.0	24.22	-15	39.22	19.28	43.50	H
277.3	27.84	-10	37.84	18.16	46.00	H
672.0	34.64	-1	35.64	11.36	46.00	H
768.0	36.93	0	36.93	9.07	46.00	H

RSE-1M-CH19-1GHz-3GHz

Frequency (MHz)	MaxPeak(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
2652.0	57.32	18	39.32	16.68	74.00	V
2934.1	54.64	18	36.64	19.36	74.00	H

RSE-1M-CH19-1GHz-3GHz

Frequency (MHz)	Average(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
2652.0	47.53	18	29.53	6.47	54.00	V

2934.1	41.96	18	23.96	12.04	54.00	H
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RSE-1M-CH19-3GHz-18GHz

Frequency (MHz)	MaxPeak(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
4879.8	46.33	-3	49.33	27.67	74.00	V
7320.0	51.14	-2	53.14	22.86	74.00	H

RSE-1M-CH19-3GHz-18GHz

Frequency (MHz)	Average(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
4879.8	40.29	-3	43.29	13.71	54.00	V
7320.0	48	-2	50	6.00	54.00	H

RSE-1M-CH39-30MHz-1GHz

Frequency (MHz)	QuasiPeak(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
36.0	12.14	-14	26.14	27.86	40.00	V
144.0	24.08	-17	41.08	19.42	43.50	H
168.0	23.16	-15	38.16	20.34	43.50	H
480.0	32.69	-6	38.69	13.31	46.00	H
672.0	33.15	-1	34.15	12.85	46.00	H
768.0	36.8	0	36.8	9.20	46.00	H

RSE-1M-CH39-1GHz-3GHz

Frequency (MHz)	MaxPeak(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
2607.9	55.71	17	38.71	18.29	74.00	H
2922.2	54.56	18	36.56	19.44	74.00	V

RSE-1M-CH39-1GHz-3GHz

Frequency (MHz)	Average(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
2607.9	45.7	17	28.7	8.30	54.00	H
2922.2	41.83	18	23.83	12.17	54.00	V

RSE-1M-CH39-3GHz-18GHz

Frequency (MHz)	MaxPeak(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
4959.9	45.18	-3	48.18	28.82	74.00	H
7440.0	49.56	-2	51.56	24.44	74.00	V
9920.1	44.53	-1	45.53	29.47	74.00	H

RSE-1M-CH39-3GHz-18GHz

Frequency (MHz)	Average(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
4959.9	39.75	-3	42.75	14.25	54.00	H
7440.0	45.82	-2	47.82	8.18	54.00	V
9920.1	33.76	-1	34.76	20.24	54.00	H

RSE-2M-CH0-30MHz-1GHz

Frequency (MHz)	QuasiPeak(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
33.4	10.45	-15	25.45	29.55	40.00	V
144.0	23.72	-17	40.72	19.78	43.50	H
168.0	24.66	-15	39.66	18.84	43.50	H
276.1	28.49	-10	38.49	17.51	46.00	H
480.0	33.69	-6	39.69	12.31	46.00	H
768.0	37.1	0	37.1	8.90	46.00	H

RSE-2M-CH0-1GHz-3GHz

Frequency (MHz)	MaxPeak(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
2653.3	54.5	18	36.5	19.50	74.00	V
2891.4	54.39	17	37.39	19.61	74.00	V

RSE-2M-CH0-1GHz-3GHz

Frequency (MHz)	Average(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
2653.3	41.91	18	23.91	12.09	54.00	V
2891.4	41.45	17	24.45	12.55	54.00	V

RSE-2M-CH0-3GHz-18GHz

Frequency (MHz)	MaxPeak(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
4804.2	48.92	-4	52.92	25.08	74.00	V
7206.1	51.59	-2	53.59	22.41	74.00	H
16118.4	47.79	9	38.79	26.21	74.00	H

RSE-2M-CH0-3GHz-18GHz

Frequency (MHz)	Average(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
4804.2	45.39	-4	49.39	8.61	54.00	V
7206.1	48.63	-2	50.63	5.37	54.00	H
16118.4	35.43	9	26.43	18.57	54.00	H

RSE-2M-CH19-30MHz-1GHz

Frequency (MHz)	QuasiPeak(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
35.1	10.58	-15	25.58	29.42	40.00	V
144.0	23.8	-17	40.8	19.70	43.50	H
168.0	24.86	-15	39.86	18.64	43.50	H
262.9	23.92	-11	34.92	22.08	46.00	H
480.0	34	-6	40	12.00	46.00	H
768.0	36.77	0	36.77	9.23	46.00	H

RSE-2M-CH19-1GHz-3GHz

Frequency (MHz)	MaxPeak(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
2668.1	56.52	18	38.52	17.48	74.00	V
2947.9	55.29	18	37.29	18.71	74.00	H

RSE-2M-CH19-1GHz-3GHz

Frequency (MHz)	Average(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
2668.1	45.25	18	27.25	8.75	54.00	V
2947.9	42.44	18	24.44	11.56	54.00	H

RSE-2M-CH19-3GHz-18GHz

Frequency (MHz)	MaxPeak(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
4879.8	45.46	-3	48.46	28.54	74.00	V
7320.0	51.76	-2	53.76	22.24	74.00	H
16444.6	47.1	9	38.1	26.90	74.00	H

RSE-2M-CH19-3GHz-18GHz

Frequency (MHz)	Average(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
4879.8	40.39	-3	43.39	13.61	54.00	V
7320.0	48.72	-2	50.72	5.28	54.00	H
16444.6	34.63	9	25.63	19.37	54.00	H

RSE-2M-CH39-30MHz-1GHz

Frequency (MHz)	QuasiPeak(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
31.9	8.51	-15	23.51	31.49	40.00	V
144.0	23.91	-17	40.91	19.59	43.50	H
168.0	24.63	-15	39.63	18.87	43.50	H
284.7	25.14	-10	35.14	20.86	46.00	H
480.0	33.33	-6	39.33	12.67	46.00	H
768.0	36.08	0	36.08	9.92	46.00	H

RSE-2M-CH39-1GHz-3GHz

Frequency (MHz)	MaxPeak(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
2673.0	55.32	18	37.32	18.68	74.00	V
2956.1	54.99	18	36.99	19.01	74.00	V

RSE-2M-CH39-1GHz-3GHz

Frequency (MHz)	Average(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
2673.0	42.13	18	24.13	11.87	54.00	V
2956.1	42.24	18	24.24	11.76	54.00	V

RSE-2M-CH39-3GHz-18GHz

Frequency (MHz)	MaxPeak(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
4959.9	44.59	-3	47.59	29.41	74.00	H
7440.0	52.28	-2	54.28	21.72	74.00	H
16497.2	48.95	10	38.95	25.05	74.00	V

RSE-2M-CH39-3GHz-18GHz

Frequency (MHz)	Average(dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Margin(dB)	Limit(dBμV/m)	Polarity
4959.9	38.77	-3	41.77	15.23	54.00	H
7440.0	49.52	-2	51.52	4.48	54.00	H
16497.2	35.3	10	25.3	18.70	54.00	V

Note:

1. The out-of- limit signal in the picture is the main frequency signal.
2. Only data in worst mode is provided.
3. Sweep the whole frequency band through the range from 30MHz to the 10th harmonic of the carrier, the Emissions in the frequency band 18GHz-26.5GHz is more than 20dB below the limit are not report.
4. The test data below 30MHz is more than 20dB lower than the limit value, so it is not provided in the report.

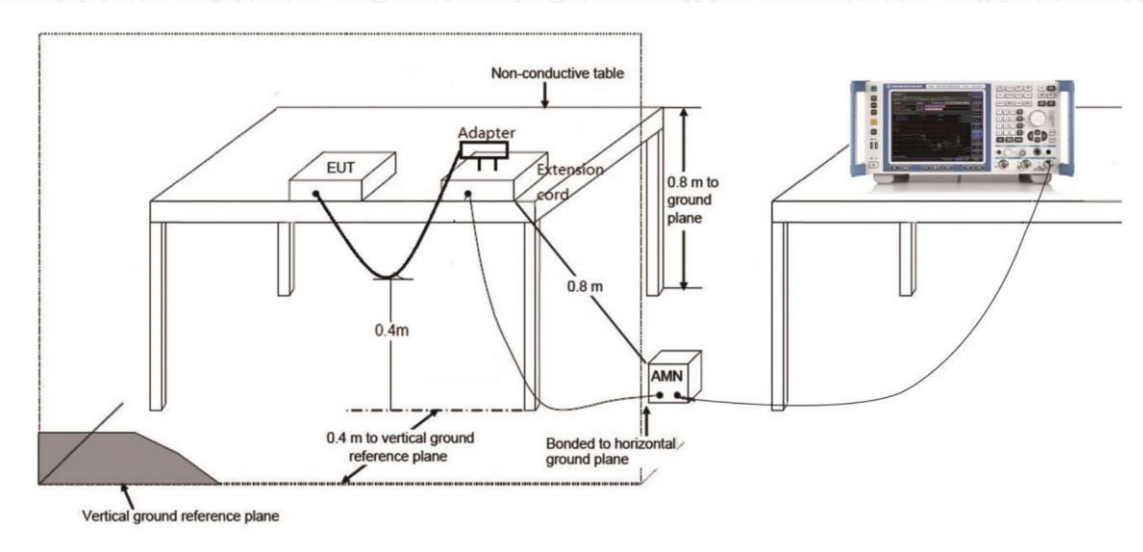
6.8 AC Powerline Conducted Emission

6.8.1 Method of Measurement: ANSI C63.10-2013-clause 6.2

1. The one EUT cable configuration and arrangement and mode of operation that produced the emission with the highest amplitude relative to the limit is selected for the final measurement, while applying the appropriate modulating signal to the EUT.
2. If the EUT is relocated from an exploratory test site to a final test site, the highest emissions shall be remaximized at the final test location before final ac power-line conducted emission measurements are performed.
3. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment in the system) is then performed for the full frequency range for which the EUT is being tested for compliance without further variation of the EUT arrangement, cable positions, or EUT mode of operation.
4. If the EUT is comprised of equipment units that have their own separate ac power connections, e.g., floor-standing equipment with independent power cords for each shelf that are able to connect directly to the ac power network, each current-carrying conductor of one unit is measured while the other units are connected to a second (or more) LISN(s). All units shall be separately measured. If a power strip is provided by the manufacturer, to supply all of the units making up the EUT, only the conductors in the power cord of the power strip shall be measured.

If the EUT uses a detachable antenna, these measurements shall be made with a suitable dummy load connected to the antenna output terminals; otherwise, the tests shall be made with the antenna connected and, if adjustable, fully extended. When measuring the ac conducted emissions from a device that operates between 150 kHz and 30 MHz a non-detachable antenna may be replaced with a dummy load for the measurements within the fundamental emission band of the transmitter, but only for those measurements.³⁶ Record the six highest EUT emissions relative to the limit of each of the current-carrying conductors of the power cords of the equipment that comprises the EUT over the frequency range specified by the procuring or regulatory agency. Diagram or photograph the test setup that was used. See Clause 8 for full reporting requirements.

6.8.2 Test Setup



6.8.3 Test Condition

Voltage (V)	Frequency (Hz)
120	60

6.8.4 Measurement limit

(Quasi-peak-average Limit)

Frequency range (MHz)	Quasi-peak Limit (dBμV)	Average Limit (dBμV)	Conclusion
0.15 to 0.5	66 to 56	56 to 46	P
0.5 to 5	56	46	
5 to 30	60	50	

NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

6.8.5 Measurement Result

Because the EUT is battery powered or charged by solar energy, adapter-related tests cannot be performed. Therefore, this test item is not applicable.

Annex A: Revised History

Version	Revised Content
V0	Initial
V1	Revise information in Section 5.2

Annex B: Accreditation Certificate



END OF REPORT