

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

SRD TEST REPORT

PRODUCT	Smart POS System
BRAND	SUNMI
MODEL	T6831
APPLICANT	Shanghai Sunmi Technology Co.,Ltd.
FCC ID	2AH25T6831
ISSUE DATE	June 6, 2024
STANDARD(S)	FCC Part15E

Prepared by: Tao Lingyan

Reviewed by: Yang Fan

Approved by: Zhang Min

**CAUTION:**

This report shall not be reproduced except in full without the written permission of the test laboratory and shall not be quoted out of context.

CONTENTS

1. SUMMARY OF TEST REPORT	3
1.1 TEST STANDARD(S)	3
1.2 REFERENCE DOCUMENTS.....	3
1.3 SUMMARY OF TEST RESULTS.....	3
1.4 DATA PROVIDED BY APPLICANT.....	5
2. GENERAL INFORMATION OF THE LABORATORY	6
2.1 TESTING LABORATORY	6
2.2 LABORATORY ENVIRONMENTAL REQUIREMENTS.....	6
2.3 PROJECT INFORMATION.....	6
3. GENERAL INFORMATION OF THE CUSTOMER.....	7
3.1 APPLICANT	7
3.2 MANUFACTURER	7
4. GENERAL INFORMATION OF THE PRODUCT.....	8
4.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT).....	8
4.2 INTERNAL IDENTIFICATION OF AE USED DURING THE TEST.....	8
4.3 ADDITIONAL INFORMATION	9
5. TEST CONFIGURATION INFORMATION	10
5.1 LABORATORY ENVIRONMENTAL CONDITIONS.....	10
5.2 TEST EQUIPMENTS UTILIZED.....	10
5.3 MEASUREMENT UNCERTAINTY	12
6. MEASUREMENT RESULTS	14
6.1. DUTY CYCLE.....	14
6.2. MAXIMUM OUTPUT POWER-CONDUCTED	15
6.3. PEAK POWER SPECTRAL DENSITY	21
6.4. OCCUPIED 26dB BANDWIDTH(CONDUCTED)	24
6.5. 99% OCCUPIED BANDWIDTH(CONDUCTED).....	27
6.6. BAND EDGES COMPLIANCE.....	29
6.7. TRANSMITTER SPURIOUS EMISSION.....	43
6.8. FREQUENCY STABILITY	81
6.9. AC POWERLINE CONDUCTED EMISSION	82
ANNEX A: REVISED HISTORY	85
ANNEX B: ACCREDITATION CERTIFICATE.....	86

1. Summary of Test Report

1.1 Test Standard(s)

No.	Test Standard	Title	Version
1	FCC Part15E	Title 47 of the Code of Federal Regulations; Chapter I Part 15 - Radio frequency devices	--

1.2 Reference Documents

No.	Test Standard	Title	Version
1	ANSI 63.10	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz	2013
2	KDB 789033 D02 General UNII Test Procedures New Rules v02r01	Information Infrastructure (U-NII) Devices - Part 15, Subpart E	--
3	KDB 484596 D01 Referencing Test Data v02r03	Test Reductions Via Data Referencing	--

Note: KDB 789033 D02 General UNII Test Procedures New Rules v02r01 and KDB 484596 D01 Referencing Test Data v02r03 are not A2LA certified.

1.3 Summary of Test Results

No.	Measurement Items	FCC Rules	Verdict
1	Maximum Output Power	15.407(a)	Pass (Note 3)
2	Power Spectral Density	15.407(a)	Pass (Note 3)
3	99% Occupied Bandwidth	N/A	Pass (Note 4)
4	-26dB Occupied Bandwidth	15. 407(a)	Pass (Note 4)
5	Band edge compliance	15.407(b)	Pass
6	Transmitter spurious emissions radiated	15.407(b)	Pass
7	Frequency Stability	15.407(g)	Pass (Note 4)
8	Transmit Power Control	15.407(h)	N/A
9	AC Powerline Conducted Emission	15.207	Pass
10	Antenna requirement	15.203	Pass (Note 2)

Note 1:

The T6831 manufactured by Shanghai Sunmi Technology Co.,Ltd. is a variant product for testing.
This project is a variant project based on the original report 23T04I30131-SRD04-V01. We verified the conduction data and tested radiated spurious emission, AC Powerline Conducted Emission in the

original report, and the test radiated spurious emission, AC Powerline Conducted Emission data was recorded in this report.

There are three configurations S10aa (Mainly Supply), S12aa (Secondary Supply) and S16aa (Thirdly supply) in this project. We mainly tested the S10aa (Mainly Supply), the S12aa (Secondary Supply) and S16aa (Thirdly supply) tested the worst mode of the mainly supply, and recorded the test results of the worst mode respectively in the report.

The description of the differences between S10aa (Mainly Supply), S12aa (Secondary Supply) and S16aa (Thirdly supply) are as follows:

Type of Service	Model Name	Scanner	Rear Camera	Flash Lamp	LCD (Just different manufacturers)
Original	T6F10	Yes	5M AF+flash	Yes	SHENZHEN DJN PHOTOELECTRIC TECHNOLOGY CO., LTD (9A-3R067-7026A)
Variant	T6831	NO	2M FF	NO	SHENZHEN DJN PHOTOELECTRIC TECHNOLOGY CO., LTD (98-31050-7084A) S10aa (Mainly Supply)
					SHENZHEN DJN PHOTOELECTRIC TECHNOLOGY CO., LTD (98-31050-7084A-H) S12aa (Secondary Supply)
					GUANGDONG SUPERVIEW OPTOELECTRONICS CO., LTD. (G499BHA085A0) S16aa (Thirdly supply)

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 FPC antenna with max Gain 2.6 dBi that complied with 15.203 Requirements.

Note 3:

The test data refer to the original report, and the data in this report is spot check data, The verification data meets the KDB484596 requirements within 3dB.

Note 4:

The test data refer to the original report, and the data in this report is spot check data.

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	2.6 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

2.2 Laboratory Environmental Requirements

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

2.3 Project Information

Project Manager	Gao Hongning
Test Date	April 15, 2024 to May 31, 2024

3. General Information of The Customer

3.1 Applicant

Company	Shanghai Sunmi Technology Co.,Ltd.
Address	Room 505, No.388,Song Hu Road, Yang Pu District, Shanghai, China
Telephone	18826519551

3.2 Manufacturer

Company	Shanghai Sunmi Technology Co.,Ltd.
Address	Room 505, No.388,Song Hu Road, Yang Pu District, Shanghai, China
Telephone	18826519551

4. General Information of The Product

4.1 Product Description for Equipment under Test (EUT)

Product Name	Smart POS System
Model name	T6831
Date of Receipt	April 15, 2024
EUT ID*	S03aa/S10aa/S12aa/S16aa
SN/IMEI	S03aa: 860104070000327'860104070005326 S10aa:860104070000897'860104070005896 S12aa:860104070001424'86010407006423 S16aa:860104070002166'86010407007165
Supported Radio Technology and Bands	GSM850/GSM900/GSM1800/GSM1900 WCDMA Band I/II/IV/V/VI/VIII/XIX LTE Band 1/2/3/4/5/7/8/18/19/20/26/28/34/38/39/40/41 BT 5.0 BR/EDR/BLE WLAN 802.11b,g,n WLAN 802.11a,n,ac GPS/Galileo/GLONASS/BDS NFC
Hardware Version	V1.0
Software Version	V3.0.4
FCC ID	2AH25T6831
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
CA01	Adapter	TPA-141A050200UU01	N/A
CDO1	Adapter	UC13US	N/A
UA02	AC Cable	N/A	N/A
BA10	Battery	HPPA	Guangdong Highpower New Energy Technology Co., Ltd.
NOTE1: AE ID is the internal identification code of the laboratory. NOTE2: By verifying that CA01+BA10 is the worst battery and adapter combination, this battery and adapter are used in all tests.			

4.3 Additional Information

WLAN Frequency	U-NII-1: 5180-5240MHz U-NII-2A: 5260-5320MHz U-NII-2C: 5500MHz-5700MHz
Occupied Channel Bandwidth	20 MHz: 802.11 a/n/ac 40 MHz: 802.11 n/ac 80 MHz: 802.11 ac
WLAN type of modulation	OFDM

Test frequency list:

UNII-1 and UNII-2A:

BW_20M	Channel	36	40	44	48	52	56	60	64
	Freq. (MHz)	5180	5200	5220	5240	5260	5280	5300	5320
BW_40M	Channel	38		46		54		62	
	Freq. (MHz)	5190		5230		5270		5310	
BW_80M	Channel	42				58			
	Freq. (MHz)	5210				5290			

UNII-2C:

BW_20M	Channel	100	104	108	112	116	120	124	128	132	136	140
	Freq. (MHz)	5500	5520	5540	5560	5580	5600	5620	5640	5660	5680	5700
BW_40M	Channel	102		110		118		126		134		/
	Freq. (MHz)	5510		5550		5590		5630		5670		/
BW_80M	Channel	106				122				/		
	Freq. (MHz)	5530				5610				/		
Note: “/” Represents empty												

Note: "/" Represents empty

Note: This report is for WLAN UNII-1, UNII-2A and UNII-2C only.

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	-10°C	50°C
Working Voltage of EUT	Normal	Minimum	Maximum
	7.7V	6.0V	8.8V

5.2 Test Equipments Utilized

5.2.1 Conducted Test System

No.	Name	Model	S/N	SW Version	HW Version	Manufacturer	Cal. Date	Cal. Interval
1	Test Software	TS1120	10727	V3.2.22	N/A	Tonscend	N/A	N/A
2	Automatic control unit	JS0806-2	2218060623	N/A	N/A	Tonscend	2024-03-25	1 Year
3	Wireless communication comprehensive tester	CMW500	164865	V3.8.12	N/A	R&S	2023-07-26	1 Year
4	Spectrum Analyzer	FSQ40	200063	V4.75	N/A	R&S	2023-10-16	1 Year
5	Analog Signal Generator	SMF	104770	V3.0.13.0-2.20.530.15.4	N/A	R&S	2023-10-16	1 year
6	Vector Signal Generator	SMCV100B	103691	V5.00.122.24	N/A	R&S	2023-07-27	1 Year
7	Programmable Power Supply	Keithley 2303	4039070	N/A	N/A	Keithley	2023-06-23	1 Year
8	Temperature box	B-TF-107C	BTF107C-201804107	N/A	N/A	Boyi	2023-06-28	1 Year
9	Network test unit AP	GT-AXE11000	N2IG0X401637KWF	V3.0.0.4.386_45940	N/A	ASUS	N/A	N/A
10	Vector Signal Generator	SMBV100A	257904	V4.15.125.49	N/A	R&S	2023-10-16	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	1 Year
2	Universal Radio Communication Tester	CMW500	104178	V3.7.20	1206.0600.00	R&S	2023-10-16	1 Year
3	EMI Test Receiver	ESU40	100307	V5.1-24-3	01	R&S	2023-12-19	1 Year
4	Trilog Antenna	VULB9162	00426	N/A	N/A	Schwarzbeck	2023-07-18	1 year
5	Double Ridged Guide Antenna	ETS-3117	00135885	N/A	N/A	ETS	2023-03-23	2 years
6	EMI Test Software	EMC32 V10.35.02	N/A	N/A	N/A	R&S	N/A	N/A
7	Horn Antenna	3160-09	LM6321	N/A	N/A	R&S	2023-07-16	1 Year
8	Horn Antenna	3160-10	LM5942	N/A	N/A	R&S	2023-07-16	1 Year
9	Loop Antenna	AL-130R	121083	N/A	N/A	COM-POWER	2023-9-13	1 Year
10	Preamplifier	SCU08F1	8320024	N/A	N/A	R&S	2023-10-16	1 Year
11	Preamplifier	SCU18	10155	N/A	N/A	R&S	2023-10-16	1 Year
12	Preamplifier	SCU26	10025	N/A	N/A	R&S	2023-10-16	1 Year
13	Preamplifier	SCU40	10020	N/A	N/A	R&S	2023-10-16	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 Precision	N/A	N/A
18	Antenna Tower	TPMDC-HF	N/A	N/A	N/A	Top Precision	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

Measurement Items	Range	Confidence Level	Calculated Uncertainty
Emission Bandwidth	5150-5850MHz	95%	±1.9%
Maximum Conduct Output Power	5150-5850MHz	95%	± 1.18 dB
Power Spectral Density	5150-5850MHz	95%	±0.98 dB
Band Edge Measurements	5150-5850MHz	95%	±1.21dB
Unwanted Emissions Measurement	9kHz-40GHz	95%	9kHz-7GHz:±1.21dB 7GHz-40GHz: ±3.31dB

Frequency Stability	5150-5850MHz	95%	±1.9%
---------------------	--------------	-----	-------

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. Measurement Results

6.1. Duty Cycle

6.1.1. Measurement Limit and Method

Standard	Limit (dBm)
FCC 47 CFR Part 15.407(a)	N/A

6.1.2. Test Procedure

The measurement method is made according to KDB 789033 B

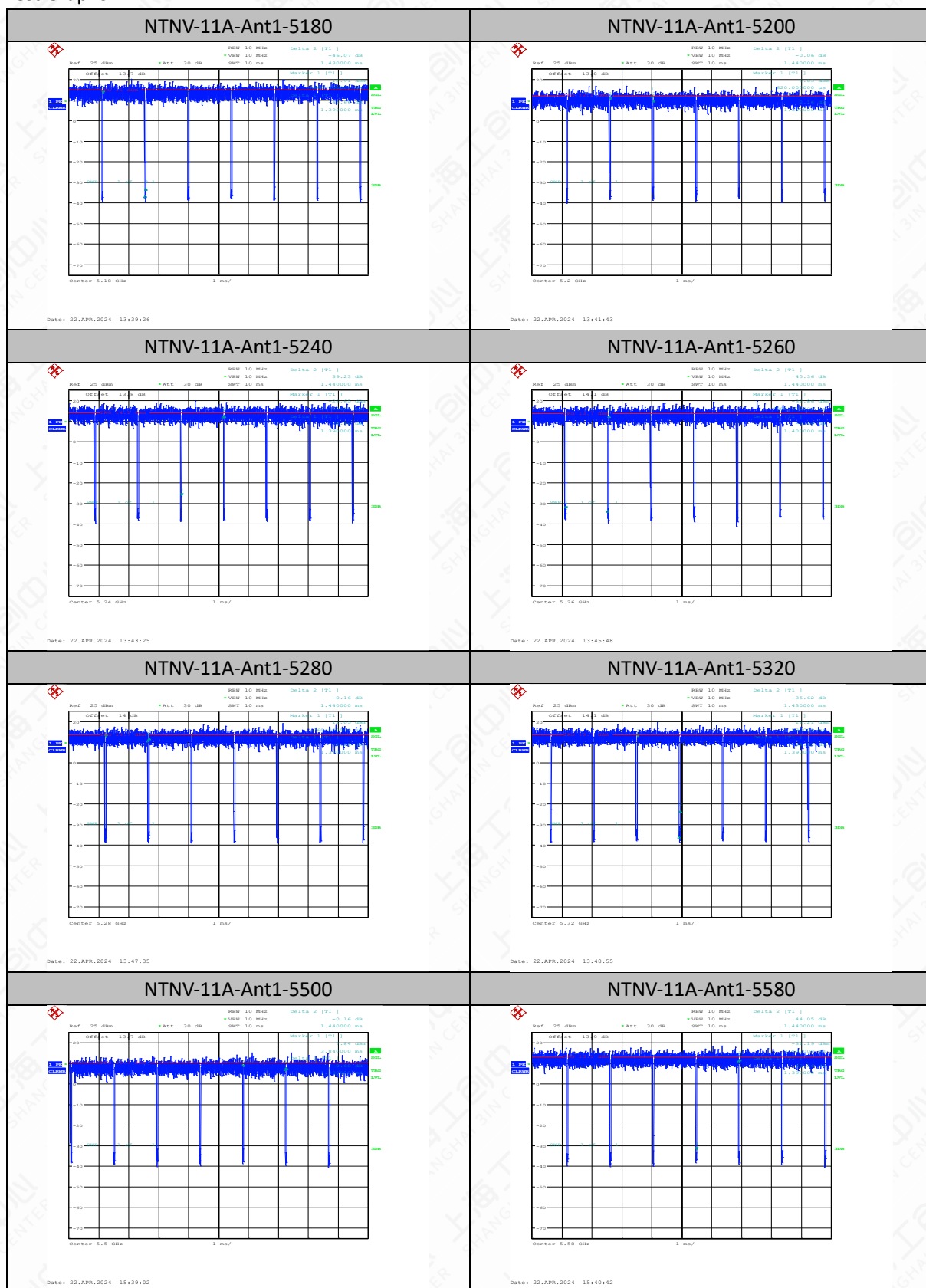
Measurements of duty cycle and transmission duration shall be performed using one of the following techniques:

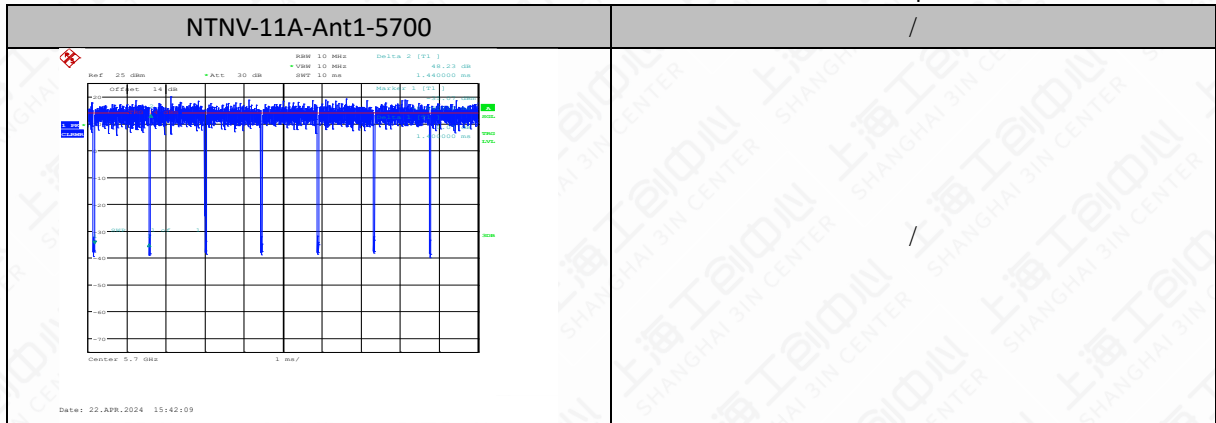
- A diode detector and an oscilloscope that together have sufficiently short response time to permit accurate measurements of the on and off times of the transmitted signal.
- The zero-span mode on a spectrum analyzer or EMI receiver, if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission, Set $RBW > EBW$ if possible; otherwise, set RBW to the largest available value. Set $VBW > RBW$. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are $> 50/T$, where T is defined in II.B.1.a), and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if $T < 16.7$ microseconds.)

6.1.3. Measurement Results

Test Mode	Antenna	Frequency [MHz]	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]
11A	Ant1	5180	1.39	1.43	97.20
11A	Ant1	5200	1.39	1.44	96.53
11A	Ant1	5240	1.39	1.44	96.53
11A	Ant1	5260	1.40	1.44	97.22
11A	Ant1	5280	1.39	1.44	96.53
11A	Ant1	5320	1.39	1.43	97.20
11A	Ant1	5500	1.39	1.44	96.53
11A	Ant1	5580	1.39	1.44	96.53
11A	Ant1	5700	1.40	1.44	97.22

Test Graphs





6.2. Maximum Output Power-Conducted

6.2.1. Measurement Limit and Method

Standard	Limit (dBm)
FCC 47 CFR Part 15.407(a)(1)(iv)	For client devices in the 5.15–5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

6.2.2. Test Procedure

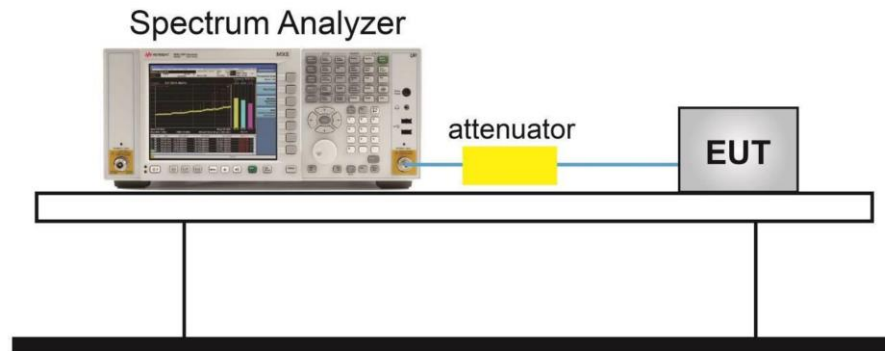
The measurement method SA-2 is made according to KDB 789033 E

Method SA-2 (trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction).

1. Measure the duty cycle, x , of the transmitter output signal as described in II.B.
2. Set span to encompass the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.
3. Set RBW = 1 MHz. (iv) Set VBW $\geq$ 3 MHz.
4. Number of points in sweep $\geq 2 \times \text{span} / \text{RBW}$. (This ensures that bin-to-bin spacing is $\leq \text{RBW}/2$, so that narrowband signals are not lost between frequency bins.)
5. Sweep time = auto.
6. Detector = power averaging (rms), if available. Otherwise, use sample detector mode.
7. Do not use sweep triggering. Allow the sweep to “free run.”
8. Trace average at least 100 traces in power averaging (rms) mode; however, the number of traces to be averaged shall be increased above 100 as needed to ensure that the average accurately represents the true average over the on and off periods of the transmitter.
9. Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument’s band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.

Add $10 \log (1/x)$, where x is the duty cycle, to the measured power to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission). For example, add $10 \log (1/0.25) = 6 \text{ dB}$ if the duty cycle is 25%

6.2.3. Test setup



6.2.4. Measurement Results

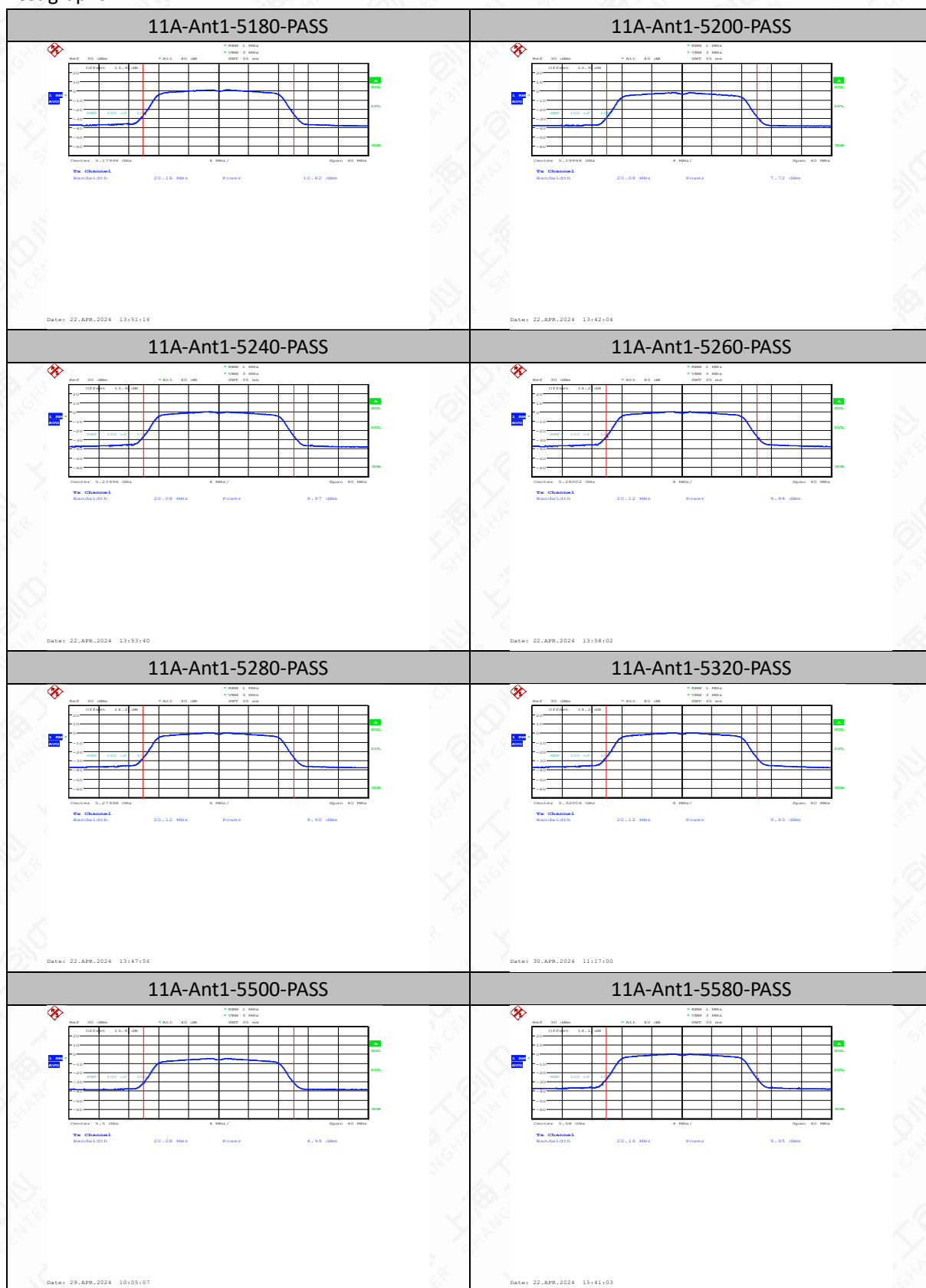
Test Mode	Frequency [MHz]	Set Power	Duty Cycle [%]	DC Factor [dBm]	Original Power [dBm]	Validation Power [dBm]	d_{dB}^{Note6}	Limit [dBm]	Gain [dBi]	EIRP [dBm]
11A	5180	15.5	97.20	0.12	10.74	10.82	-0.08	≤ 23.98	2.60	13.42
11A	5200	13	96.53	0.15	6.91	7.72	-0.81	≤ 23.98	2.60	10.32
11A	5240	15.5	96.53	0.15	9.15	9.97	-0.82	≤ 23.98	2.60	12.57
11A	5260	15.5	97.22	0.12	9.28	9.94	-0.66	≤ 23.98	2.60	12.54
11A	5280	15.5	96.53	0.15	9.13	9.90	-0.77	≤ 23.98	2.60	12.50
11A	5320	15.5	97.20	0.12	9.38	9.93	-0.55	≤ 23.98	2.60	12.53
11A	5500	11.5	96.53	0.15	4.21	4.99	-0.78	≤ 23.98	2.60	7.59
11A	5580	15.5	96.53	0.15	9.03	9.95	-0.92	≤ 23.98	2.60	12.55
11A	5700	15.5	97.22	0.12	10.12	10.49	-0.37	≤ 23.98	2.60	13.09

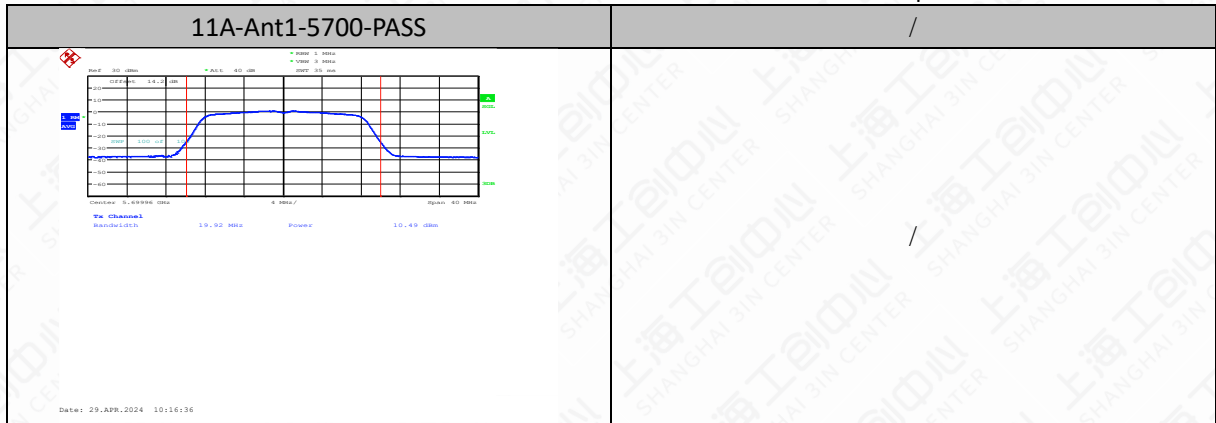
Note:

- 1.The Duty Cycle Factor is compensated in the graph.
 2. In the graph, the Center frequency = (Low frequency of 26dB OBW + High frequency of 26dB OBW) / 2.
 - 3.The 11a data rate 6Mbps is selected as worse condition, 11n/11ac data rate MCS0 is selected as worse condition, and the following cases are performed with this condition.
 4. For client devices in the 5.15–5.25 GHz band, Limit = 250mW; For the 5.25–5.35 GHz and 5.47–5.725 GHz bands: Limit = Min (250mW, 11dBm+10log B), B is the 26 dB emission bandwidth in megahertz.
- Note5:The verified power is still in the tune-up power range and meets the requirements of KDB484596 D01 data reference. The power listed in the original certificate still applies to this case.

Note6: $d_{dB} = |\text{Verified}_{dB} - \text{original}_{dB}|$

Test graphs





6.3. Peak Power Spectral Density

6.3.1. Measurement Limit

Standard	Limit (dBm)
FCC 47 CFR Part 15.407(a)(1)(iv)	≤ 11

6.3.2. Test Procedure

The measurement method is made according to KDB 789033 F

1. Create an average power spectrum for the EUT operating mode being tested by following the instructions in II.E.2. for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, "Compute power...." (This procedure is required even if the maximum conducted output power measurement was performed using a power meter, method PM.)
2. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
3. Make the following adjustments to the peak value of the spectrum, if applicable:
 - a) If Method SA-2 or SA-2 Alternative was used, add $10 \log (1/x)$, where x is the duty cycle, to the peak of the spectrum.
 - b) If Method SA-3 Alternative was used and the linear mode was used in step II.E.2.g)(viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging.
4. The result is the Maximum PSD over 1 MHz reference bandwidth.
5. For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in Section 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, "provided that the measured power is integrated over the full reference bandwidth" to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:
 - a) Set $RBW \geq 1/T$, where T is defined in II.B.I.a).
 - b) Set $VBW \geq 3$ RBW.
 - c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add $10 \log (500 \text{ kHz}/RBW)$ to the measured result, whereas RBW (< 500 kHz) is the reduced resolution bandwidth of the spectrum

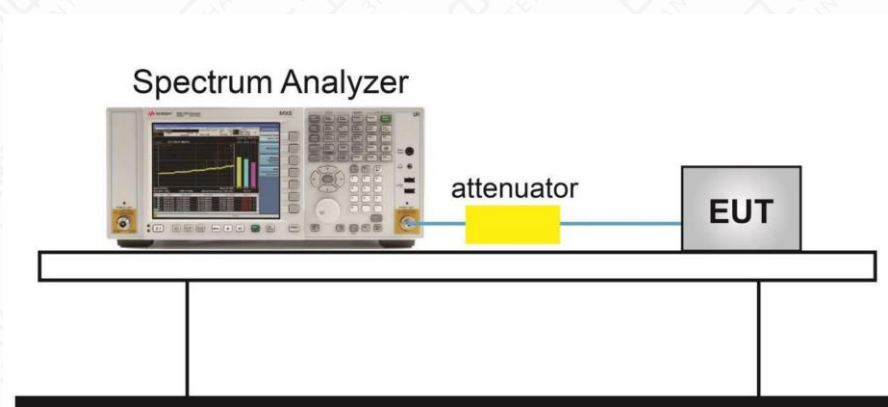
analyzer set during measurement.

d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add $10 \log (1\text{MHz}/\text{RBW})$ to the measured result, whereas $\text{RBW} (< 1 \text{ MHz})$ is the reduced resolution bandwidth of spectrum analyzer set during measurement.

e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Note: As a practical matter, it is recommended to use reduced RBW of 100 kHz for steps 5.c) and 5.d) above, since $\text{RBW}=100 \text{ KHZ}$ is available on nearly all spectrum analyzers.

6.3.3. Test setup



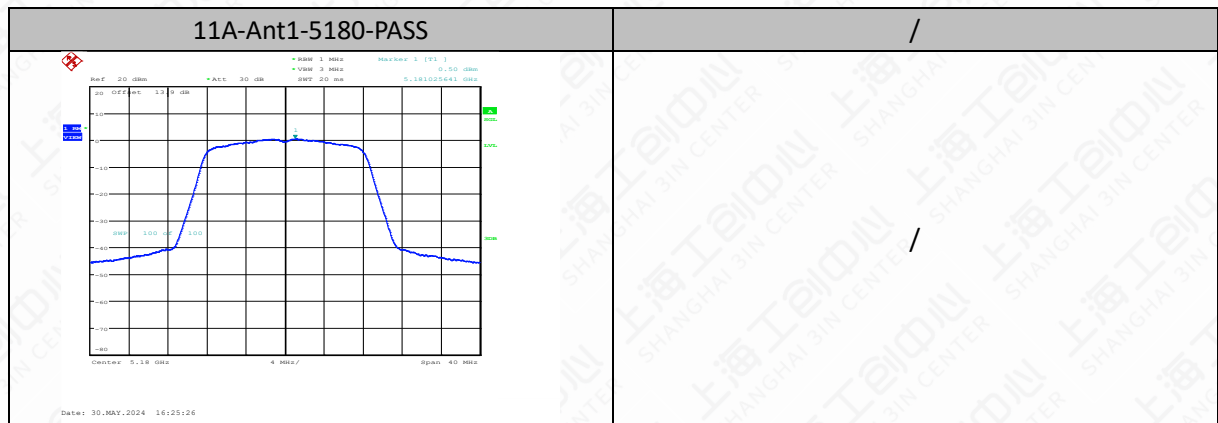
6.3.4. Measurement Results

TestMode	Antenna	Frequency[MHz]	Result [dBm/MHz]	Limit[dBm/MHz]	Verdict
11A	Ant1	5180	0.50	≤ 11.00	PASS

Note:

1. $\text{EIRP} = \text{Power Spectral Density}(\text{dBm}/\text{MHz}) + \text{Antenna gain}(\text{dBi})$
2. The Duty Cycle Factor is compensated in the graph.

Test Graphs



6.4. Occupied 26dB Bandwidth(conducted)

6.4.1 Measurement Limit

Standard	Limit(MHz)
FCC 47 CFR Part 15.407(a)	N/A

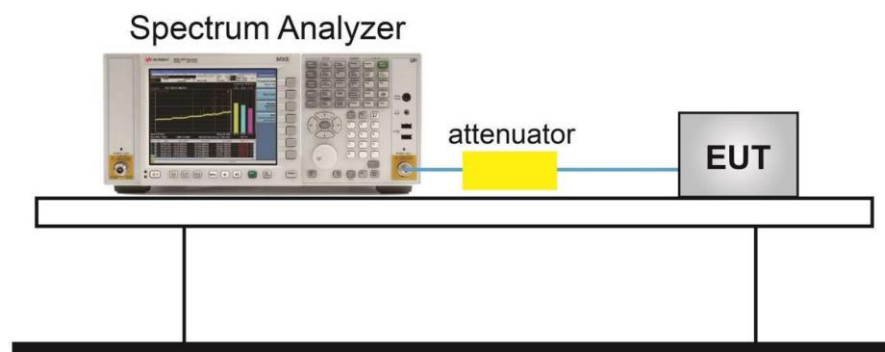
6.4.2 Test Procedure

The measurement method is made according to KDB 789033 C

1. Set RBW = approximately 1% of the emission bandwidth
2. Set the VBW > RBW
3. Detector = Peak.
4. Trace mode = max hold.
5. Measure the maximum width of the emission that is 26 dB down from the maximum of the emission.

Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

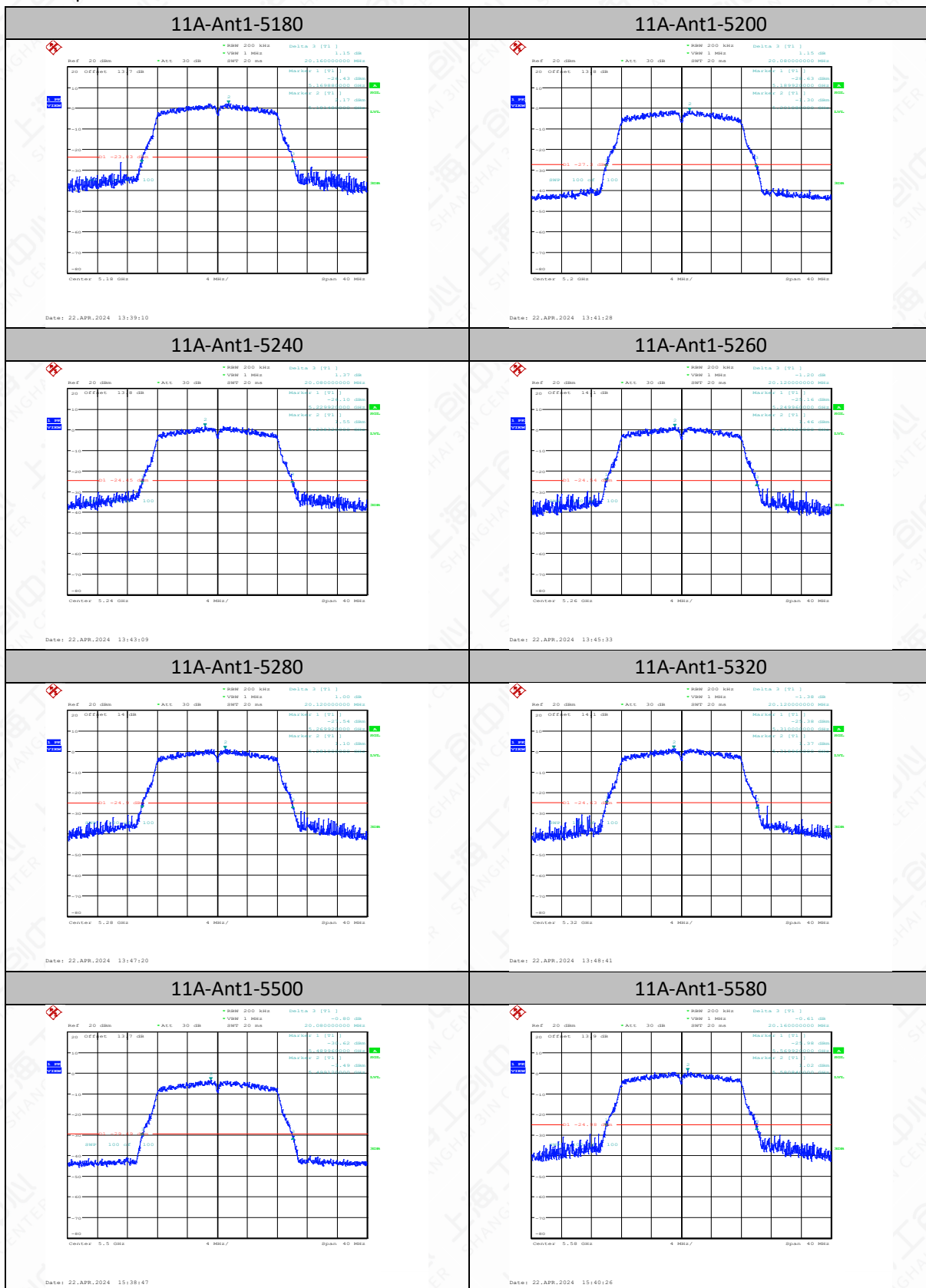
6.4.3 Test Setup

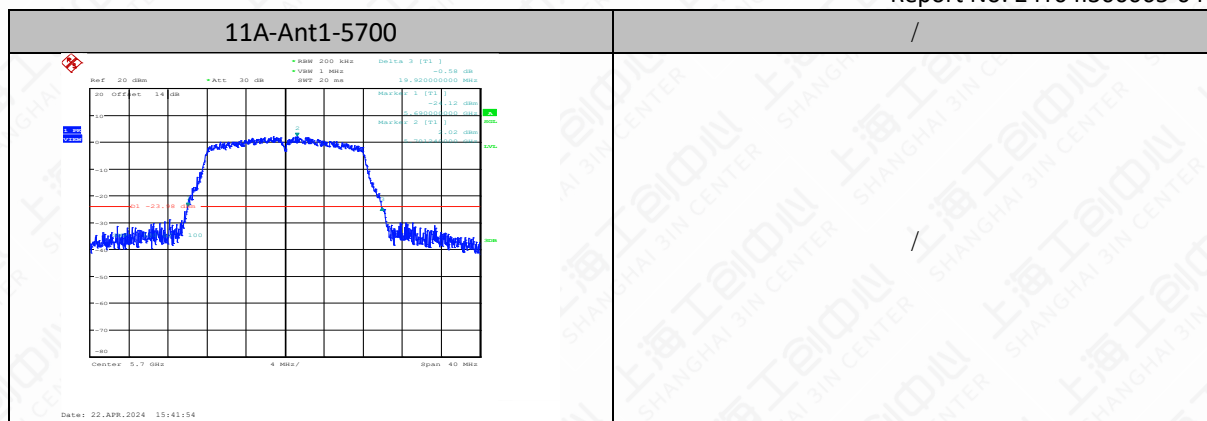


6.4.4 Measurement Results

TestMode	Antenna	Frequency[MHz]	26db EBW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11A	Ant1	5180	20.16	5169.88	5190.04	---	---
11A	Ant1	5200	20.08	5189.92	5210.00	---	---
11A	Ant1	5240	20.08	5229.92	5250.00	---	---
11A	Ant1	5260	20.12	5249.96	5270.08	---	---
11A	Ant1	5280	20.12	5269.92	5290.04	---	---
11A	Ant1	5320	20.12	5310.00	5330.12	---	---
11A	Ant1	5500	20.08	5489.96	5510.04	---	---
11A	Ant1	5580	20.16	5569.92	5590.08	---	---
11A	Ant1	5700	19.92	5690.00	5709.92	---	---

Test Graphs





6.5. 99% Occupied Bandwidth(conducted)

6.5.1 Measurement Limit

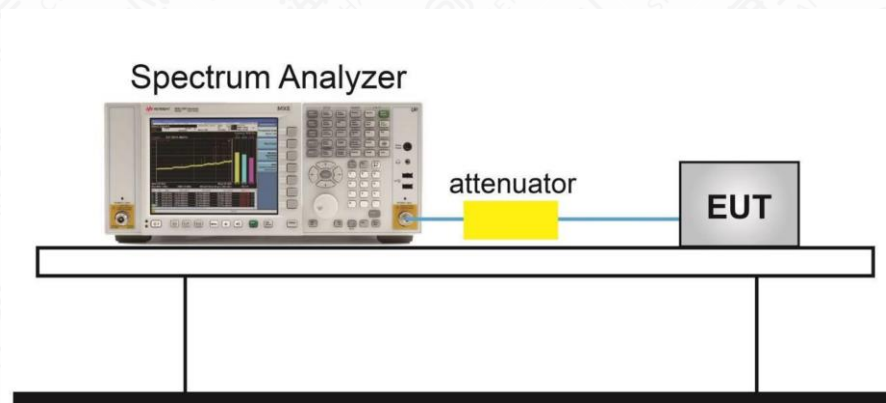
Standard	Limit(MHz)
15.407(a)	N/A

6.5.2 Test Procedure

The measurement method is made according to KDB 789033 D

1. Set center frequency to the nominal EUT channel center frequency.
2. Set span = 1.5 times to 5.0 times the OBW.
3. Set RBW = 1 % to 5 % of the OBW
4. Set VBW $\geq 3 \cdot$ RBW
5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
6. Use the 99 % power bandwidth function of the instrument (if available).
7. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

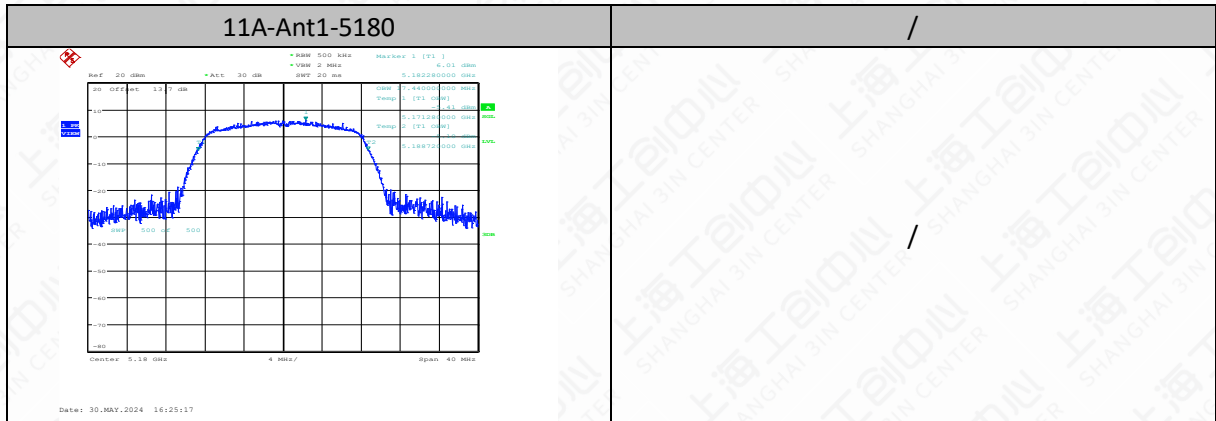
6.5.3 Test Setup



6.5.4 Measurement Results

TestMode	Antenna	Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11A	Ant1	5180	17.44	5171.2800	5188.7200	---	---

Test Graphs



6.6. Band Edges Compliance

6.6.1 Measurement Limit

Above 1G, non-restricted band

Standard	EIRP Limit
15.407(b)	< -27dBm/MHz

Above 1G, Restricted band

Standard	EIRP Limit	
15.407(b)	< -27dBm/MHz	
15.209	Peak	74dBμV/m
	Average	54dBμV/m

$$\text{EIRP[dBm]} = \text{E[dB}\mu\text{V/m]} + 20 \log(d[\text{m}]) - 104.7$$

$$\text{E[dB}\mu\text{V/m]} = \text{EIRP[dBm]} - 20 \log(d[\text{m}]) + 104.7$$

$$\text{E[dB}\mu\text{V/m]} = \text{EIRP[dBm]} + 95.2 = 68.2, \text{ for } d = 3\text{m}$$

6.6.2 Test Procedure

The measurement is made according to KDB 789033.

Marker-Delta Method: The marker-delta method, as described in ANSI C63.10, can be used to perform measurements of the radiated unwanted emissions level of emissions provided that the 99% occupied bandwidth of the fundamental is within 2 MHz of the authorized band-edge.

Procedure for peak unwanted emissions measurements above 1000 MHz

The procedure for peak unwanted emissions measurements above 1000 MHz is as follows:

a) Follow the requirements in 12.7.4.

b) Peak emission levels are measured by setting the instrument as follows:

- 1) RBW = 1 MHz.
- 2) VBW $\geq [3 \times \text{RBW}]$.
- 3) Detector = peak.
- 4) Sweep time = auto.
- 5) Trace mode = max hold.

6) Allow sweeps to continue until the trace stabilizes. Note that if the transmission is not continuous, then the time required for the trace to stabilize will increase by a factor of approximately $1/D$, where D is the duty cycle. For example, at 50% duty cycle, the measurement time will increase by a factor of two, relative to measurement time for continuous transmission.

Procedures for average unwanted emissions measurements above 1000 MHz

a) RBW = 1 MHz.

b) Video bandwidth:

1) If the EUT is configured to transmit with $D \geq 98\%$, then set $VBW \leq RBW / 100$ (i.e., 10 kHz), but not less than 10 Hz.

2) If the EUT D is $< 98\%$, then set $VBW \geq 1 / T$, where T is defined in item a1) of 12.2.

c) Video bandwidth mode or display mode:

1) The instrument shall be set with video filtering applied in the power domain. Typically, this requires setting the detector mode to RMS (power averaging) and setting the average-VBW type to power (rms).

2) As an alternative, the instrument may be set to linear detector mode. Video filtering shall be applied in linear voltage domain (rather than in a log or dB domain). Some instruments require linear display mode to accomplish this. Others have a setting for average-VBW type, which can be set to "voltage" regardless of the display mode.

d) Detector = peak.

e) Sweep time = auto.

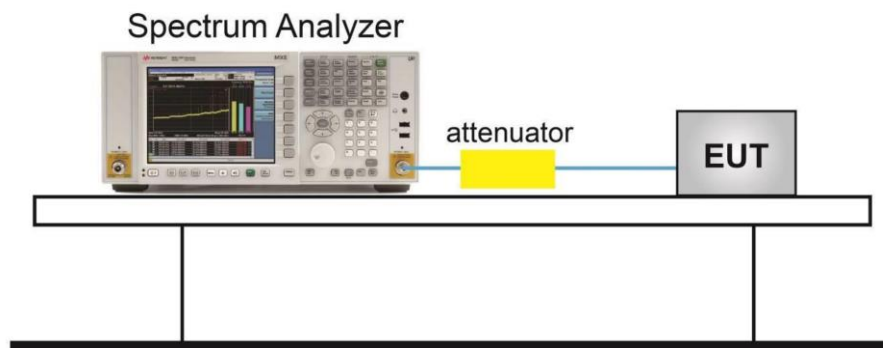
f) Trace mode = max hold.

g) Allow max hold to run for at least 50 traces if the transmitted signal is continuous or has at least 98% duty cycle. For lower duty cycles, increase the minimum number of traces by a factor of $1/x$, where D is the duty cycle. For example, use at least 200 traces if the duty cycle is 25%. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 50 traces should be averaged.)

The measurement was applied in a fully anechoic chamber. While testing for spurious emission higher than 1GHz, if applied, the pre-amplifier would be equipped just at the output terminal of the antenna. Tabletop devices shall be placed on a nonconducting platform with nominal top surface dimensions 1 m by 1.5 m. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turntable rotated 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna which was mounted on an antenna mast. During the tests, the antenna height varied from 1m to 4m and the EUT azimuth were varied from 0° to 360° in order to identify the maximum level of emissions from the EUT. 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. This

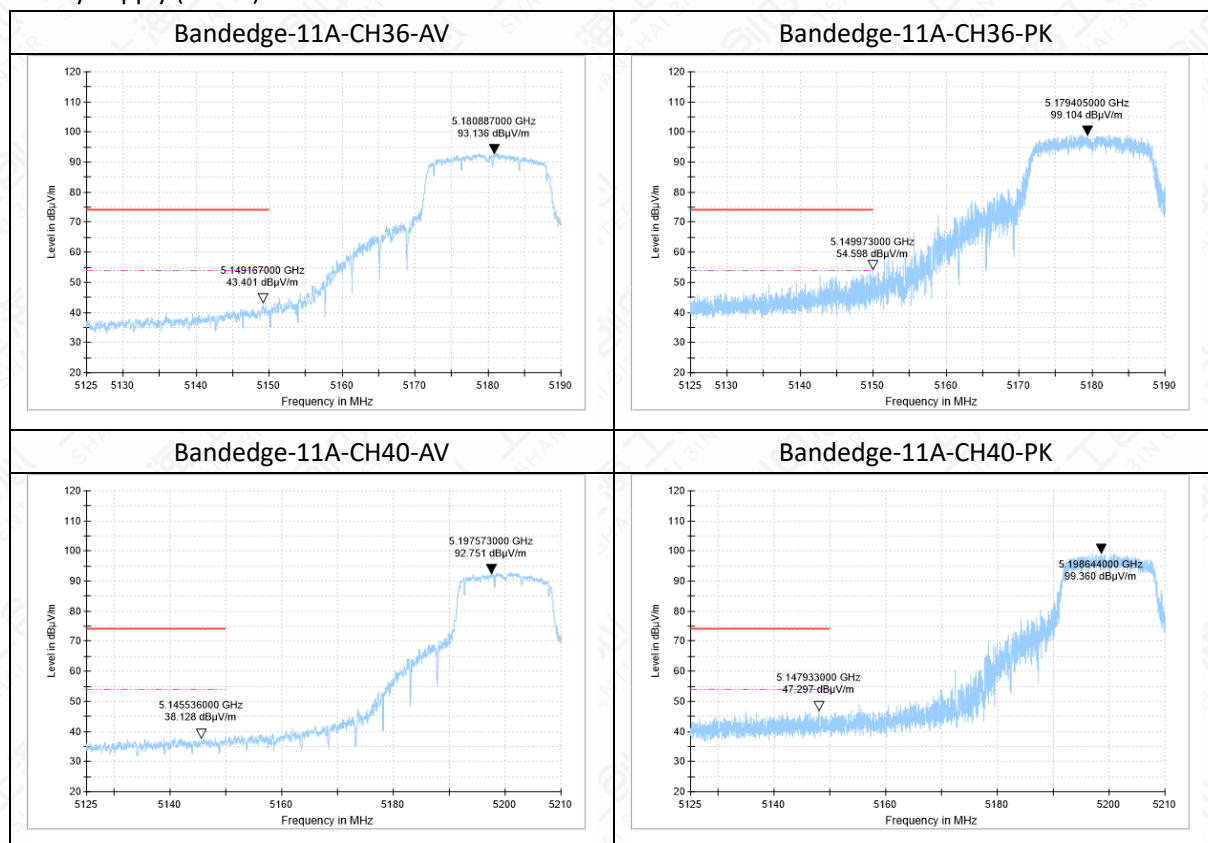
maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.

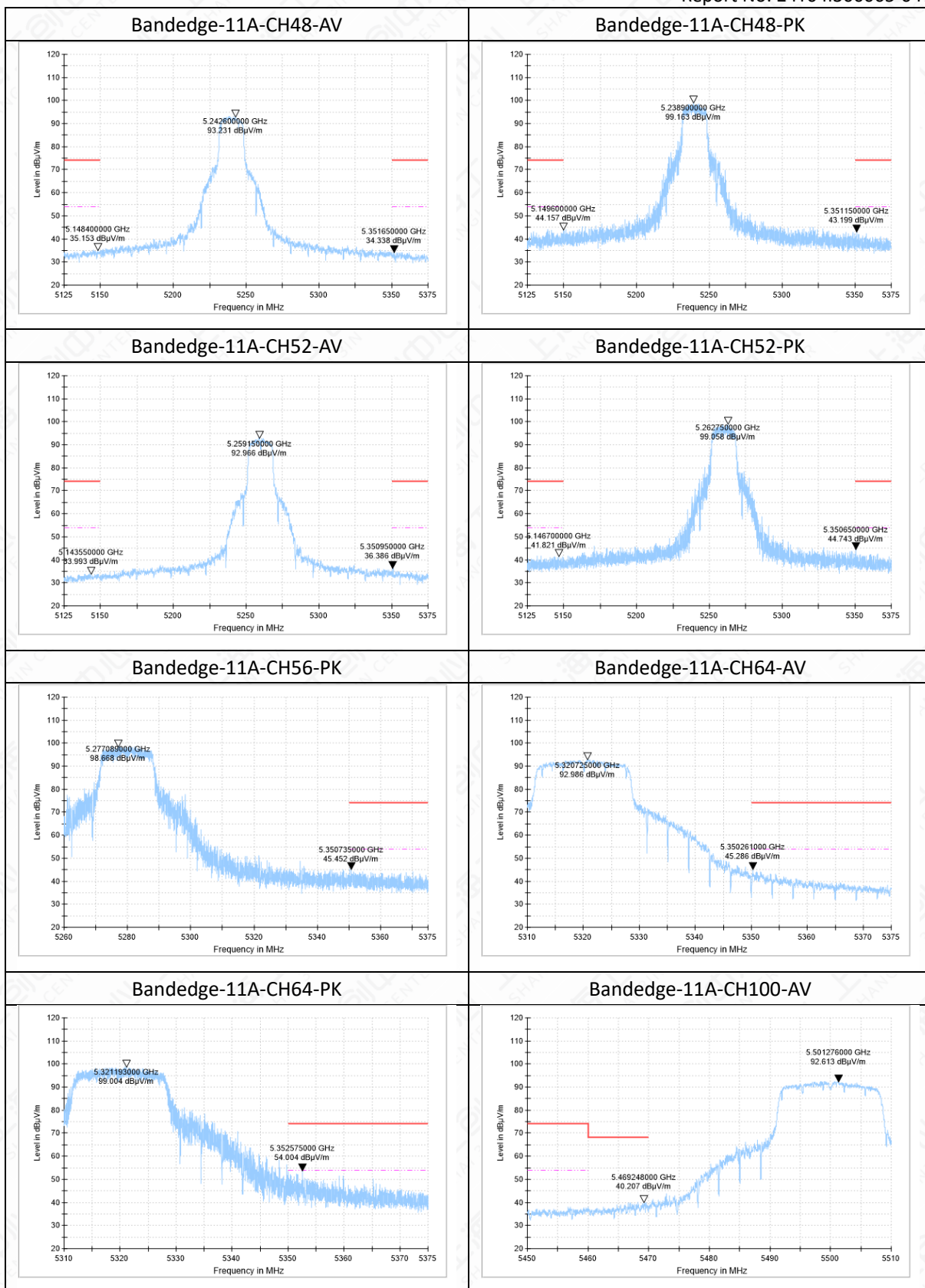
6.6.3 Test Setup

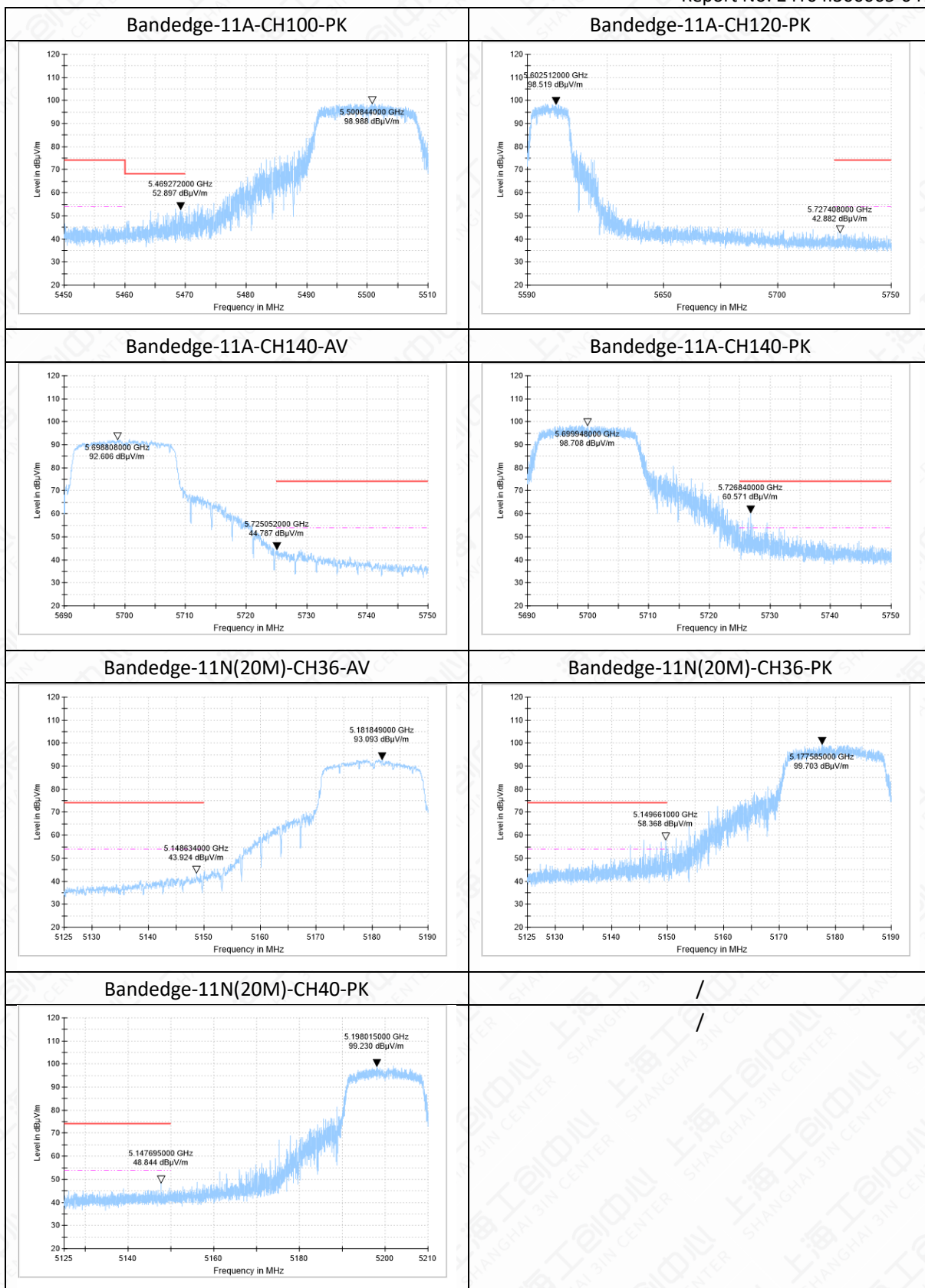


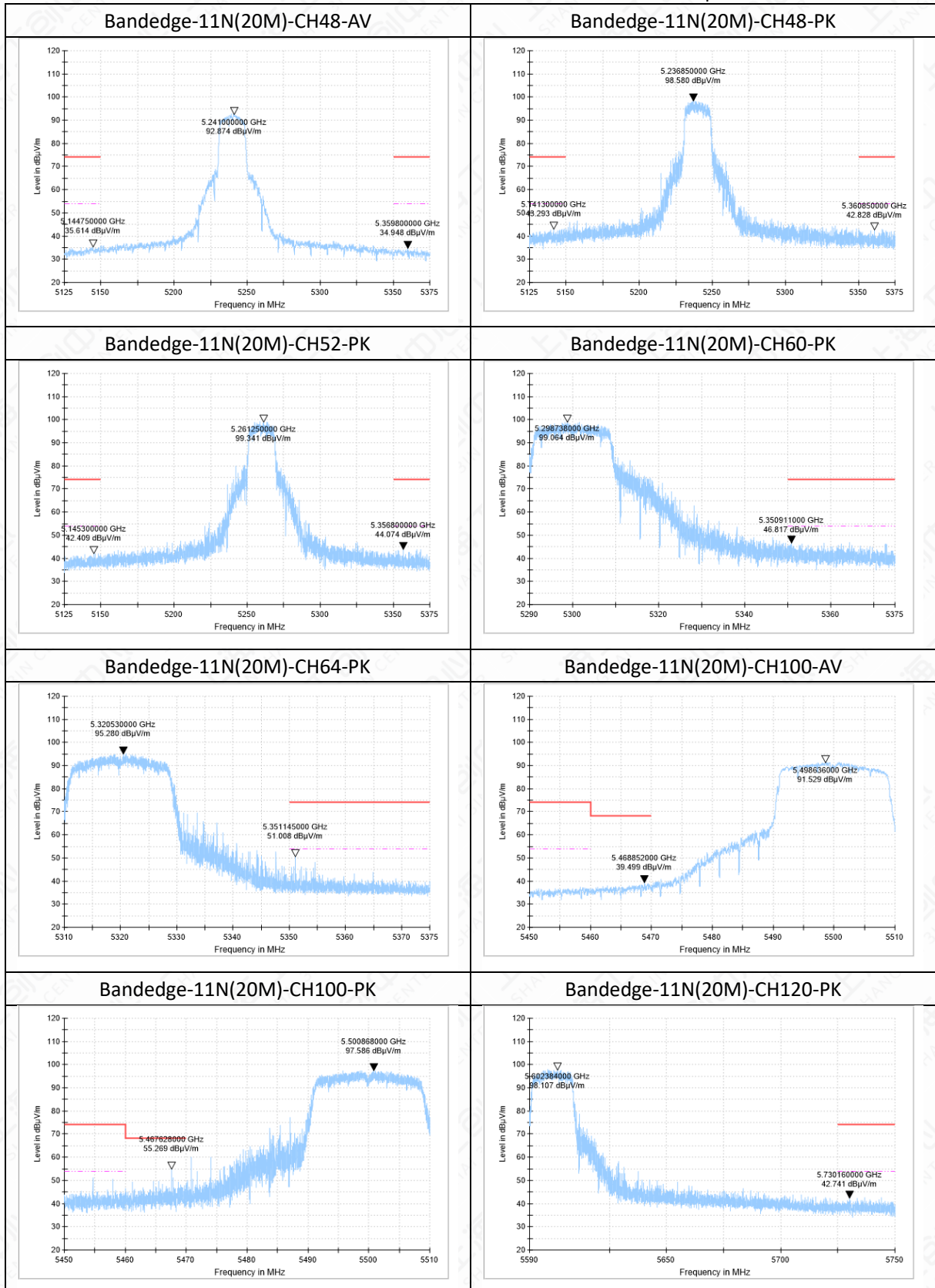
6.6.4 Measurement Result

Mainly Supply (S10aa)

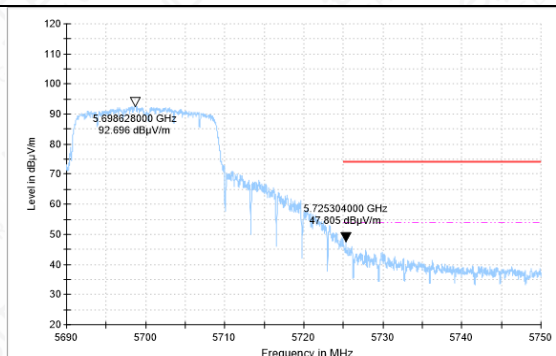




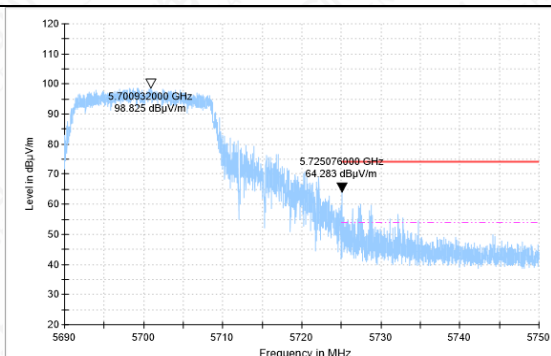




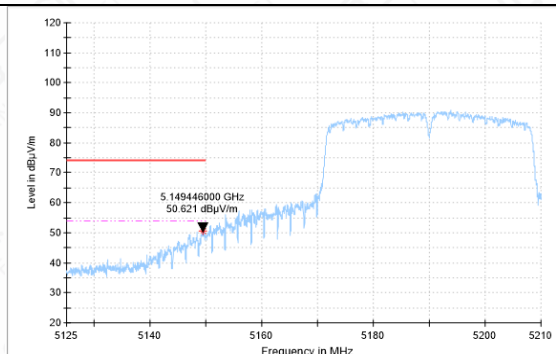
Bandedge-11N(20M)-CH140-AV



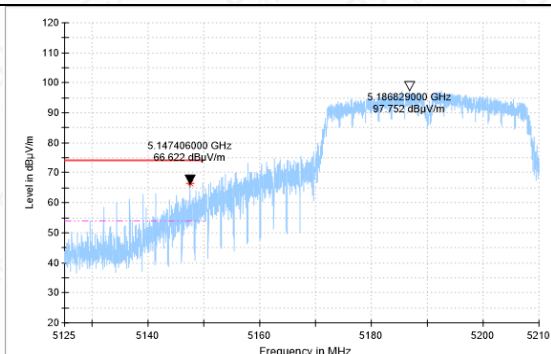
Bandedge-11N(20M)-CH140-PK



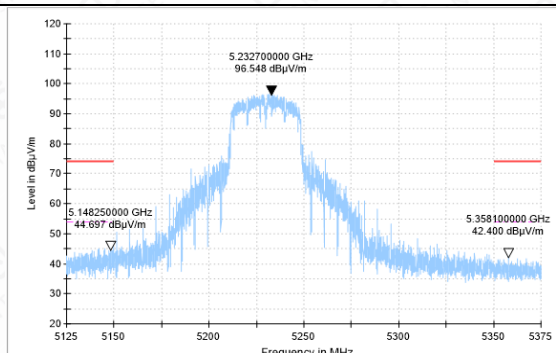
Bandedge-11N(40M)-CH38-AV



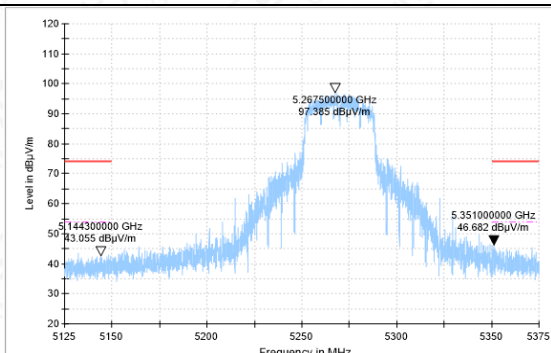
Bandedge-11N(40M)-CH38-PK



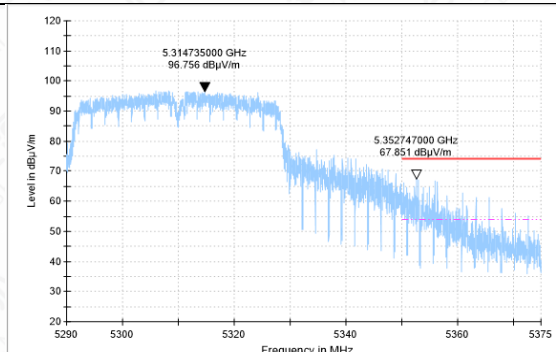
Bandedge-11N(40M)-CH46-PK



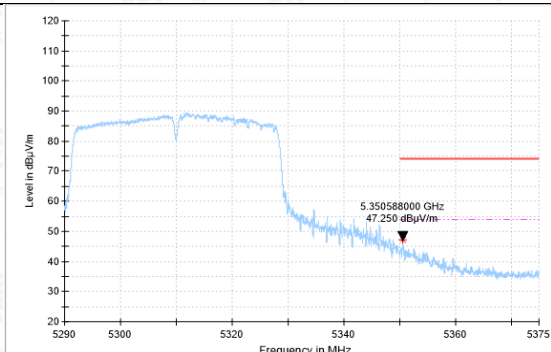
Bandedge-11N(40M)-CH54-PK

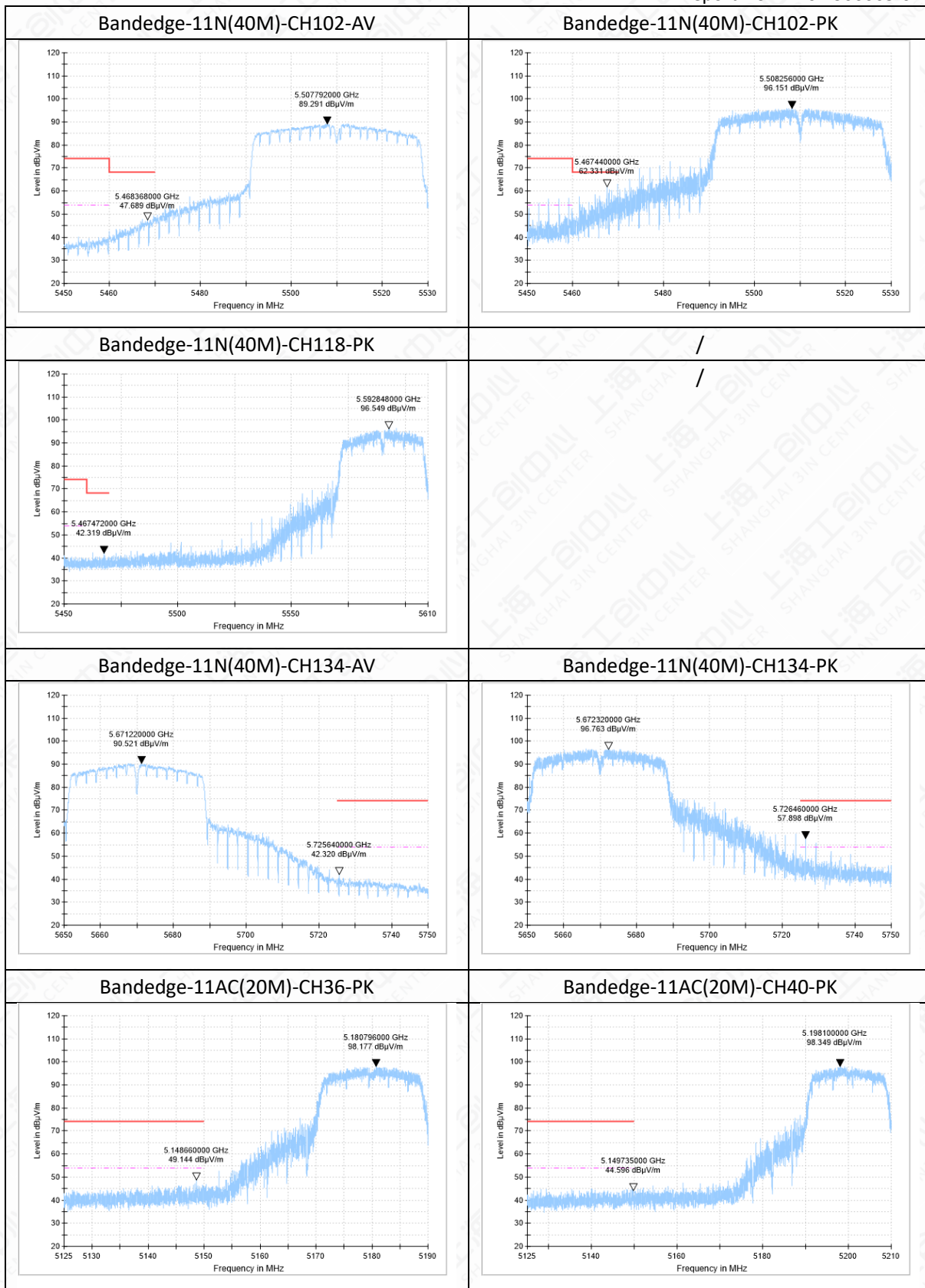


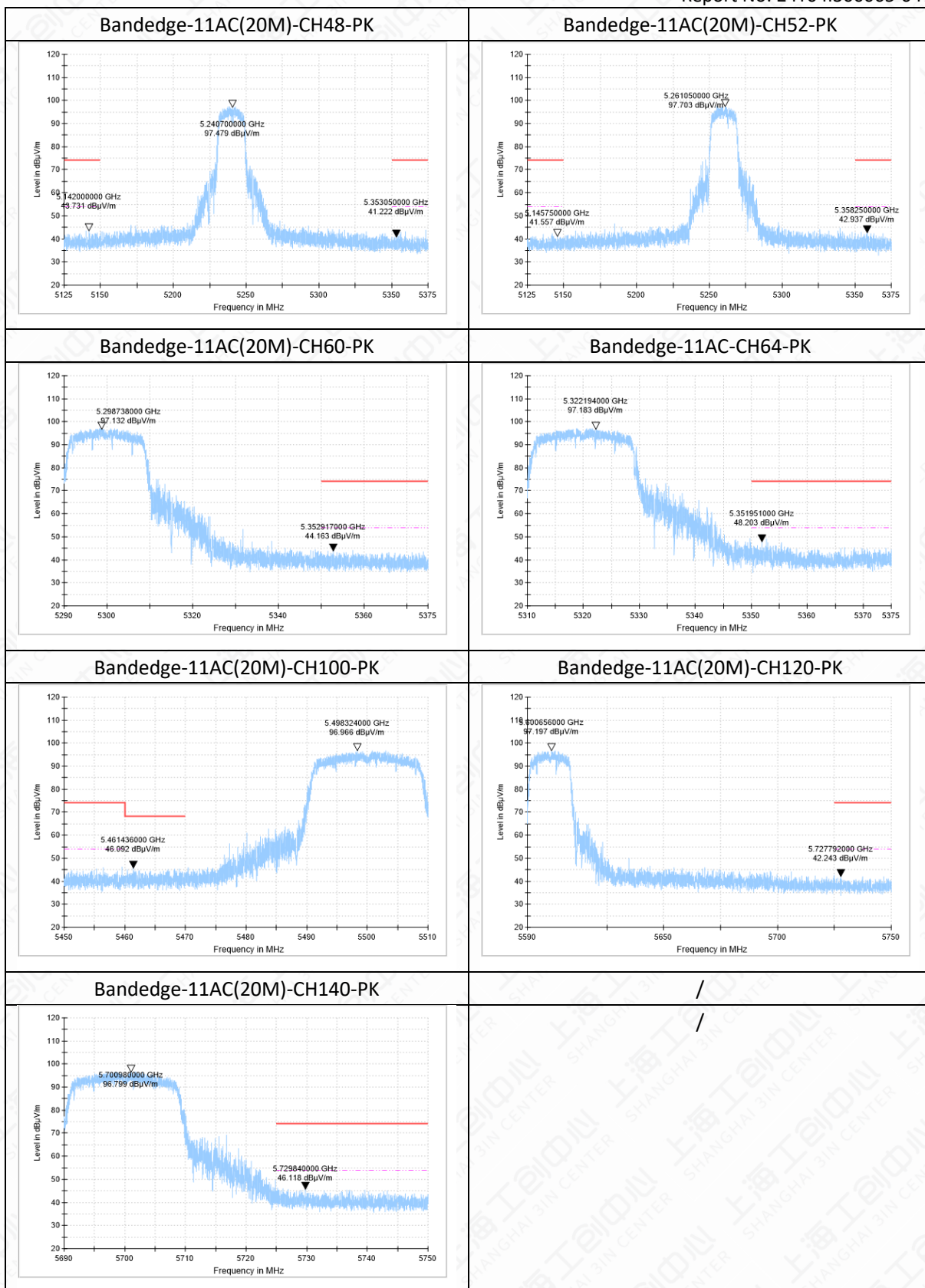
Bandedge-11N(40M)-CH62-PK



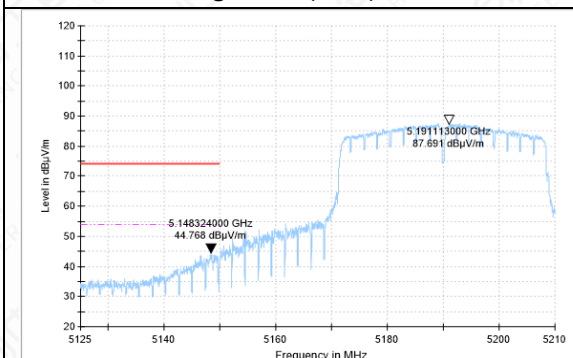
Bandedge-11N(40M)-CH64-AV



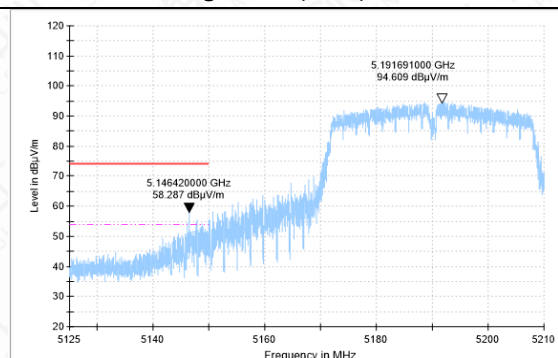




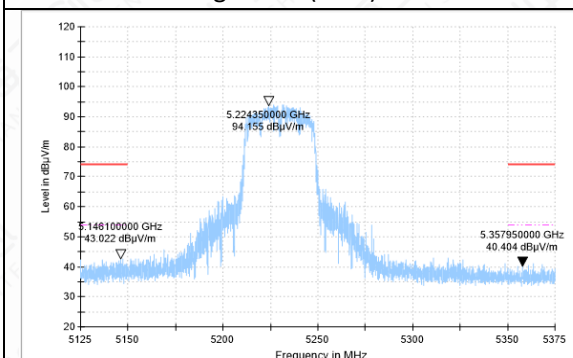
Bandedge-11AC(40M)-CH38-AV



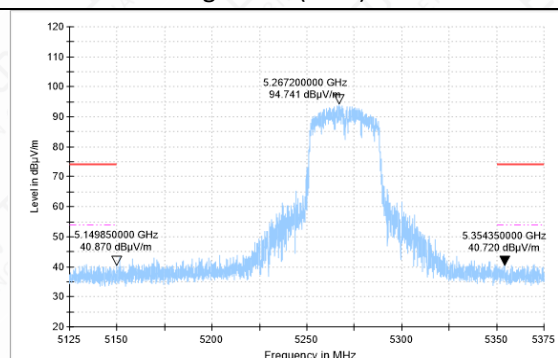
Bandedge-11AC(40M)-CH38-PK



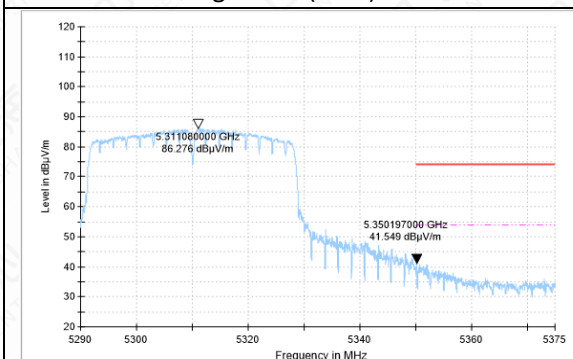
Bandedge-11AC(40M)-CH46-PK



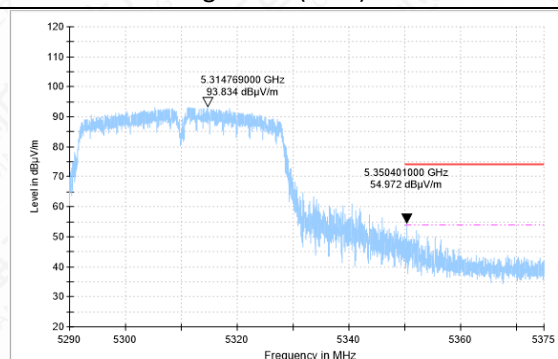
Bandedge-11AC(40M)-CH54-PK



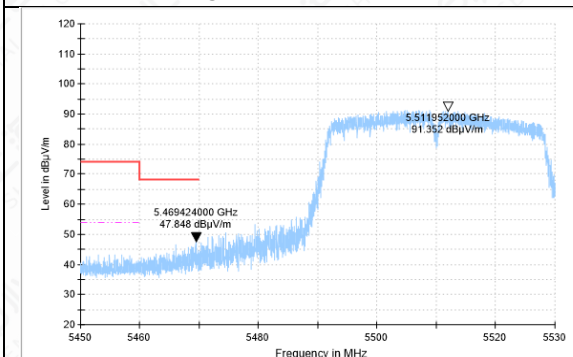
Bandedge-11AC(40M)-CH62-AV



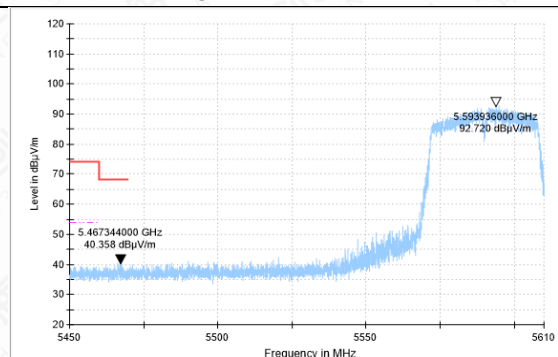
Bandedge-11AC(40M)-CH62-PK

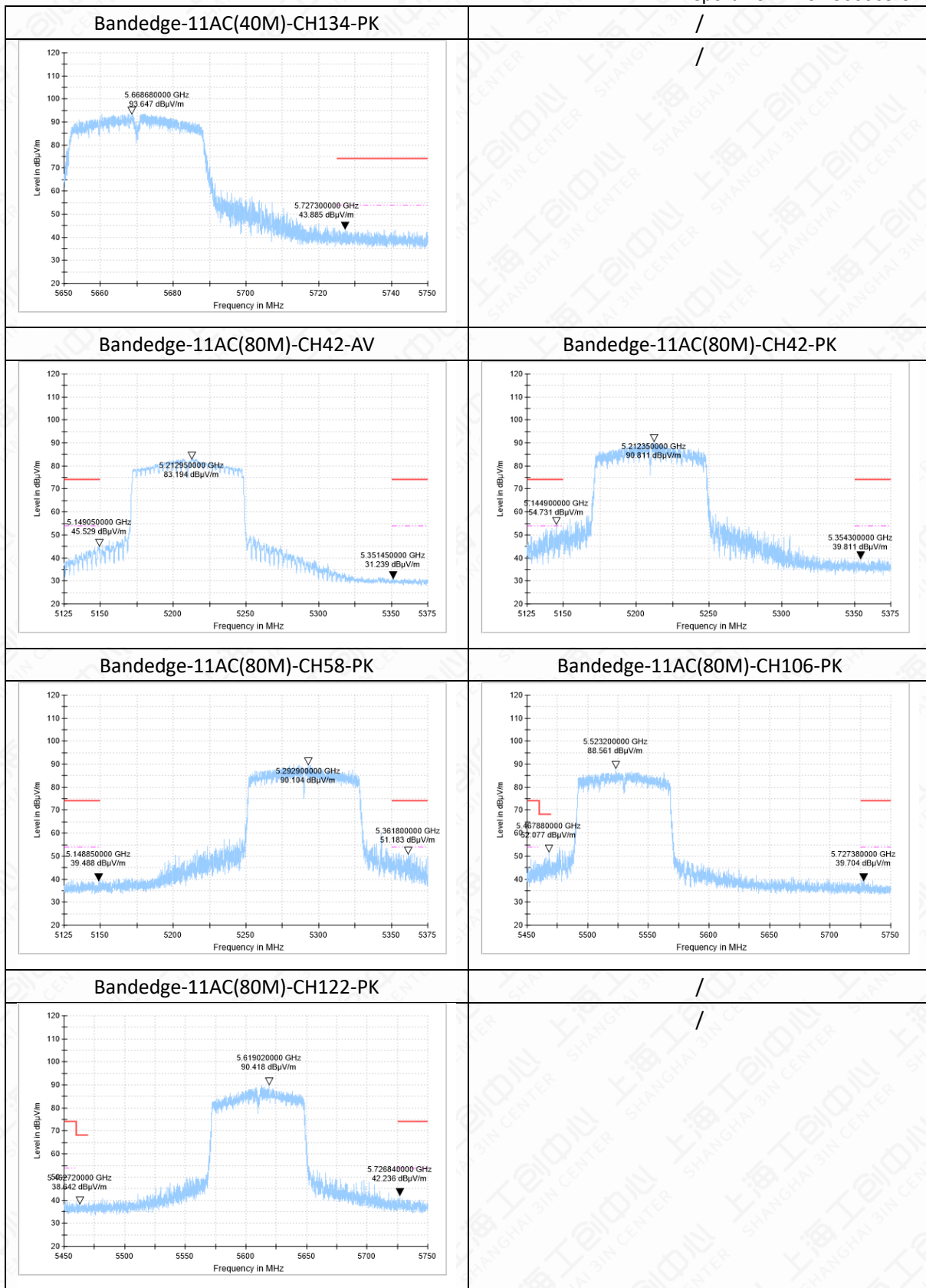


Bandedge-11AC(40M)-CH102-PK

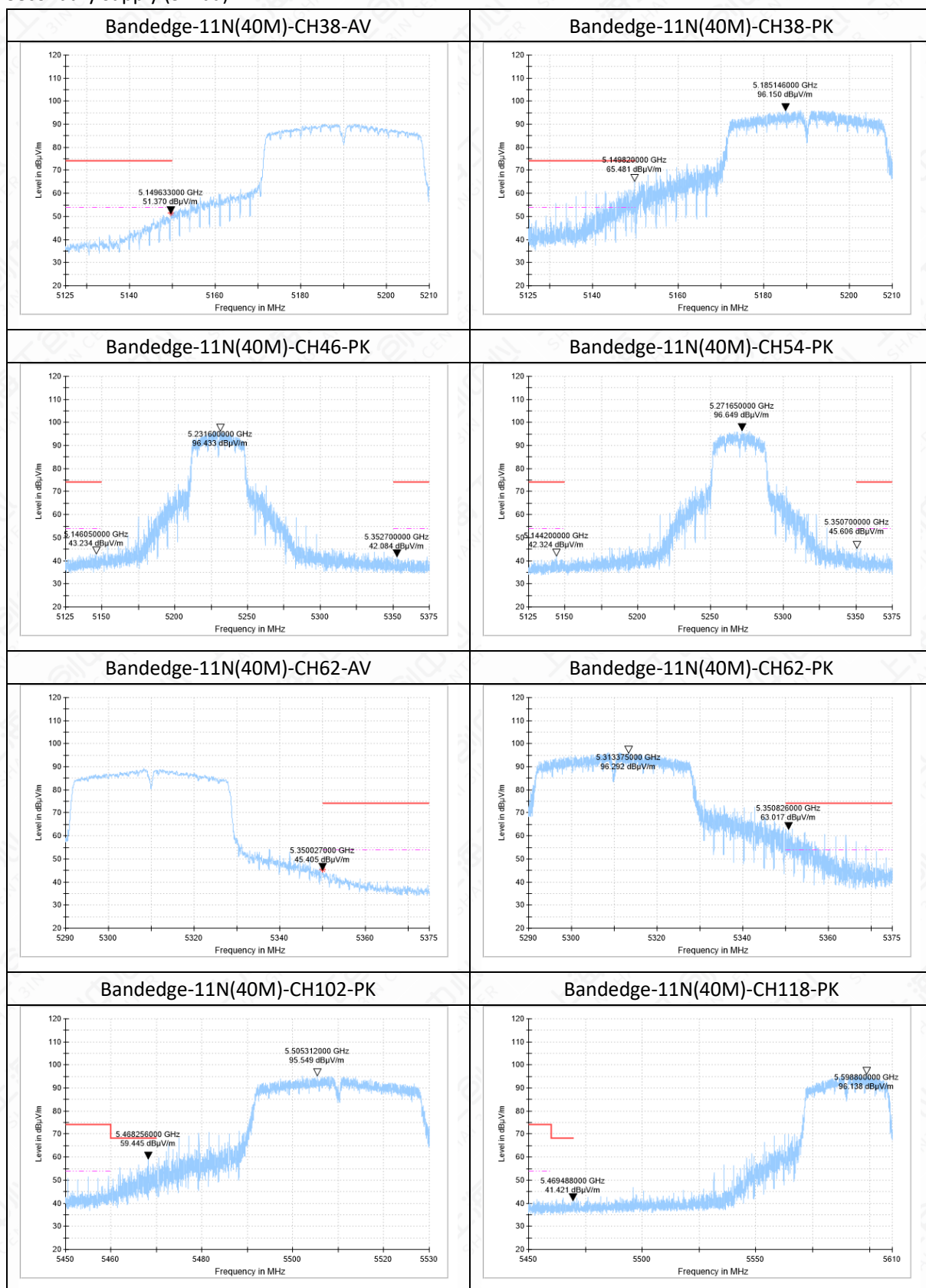


Bandedge-11AC(40M)-CH118-PK

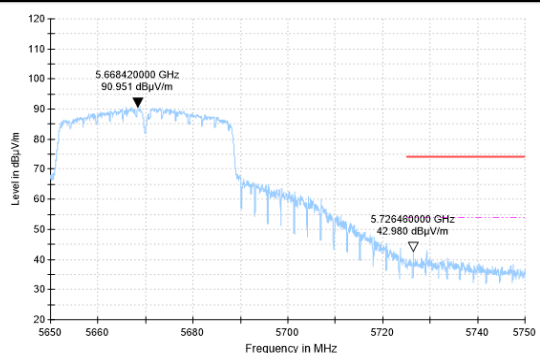




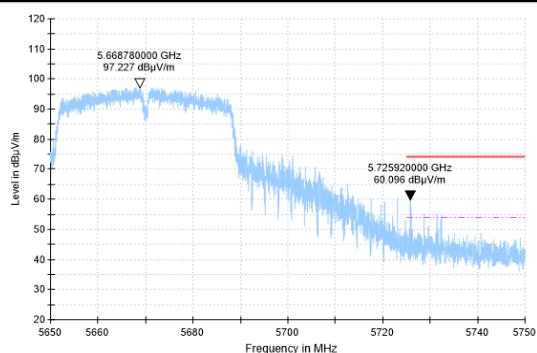
Secondary supply (S12aa)



Bandedge-11N(40M)-CH134-AV

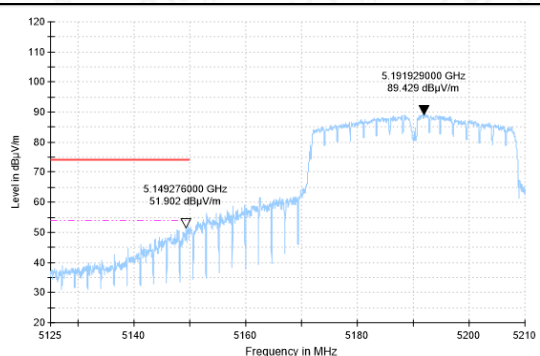


Bandedge-11N(40M)-CH134-PK

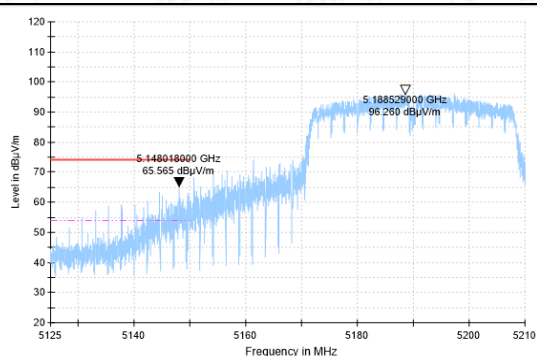


Thirdly supply(S16aa)

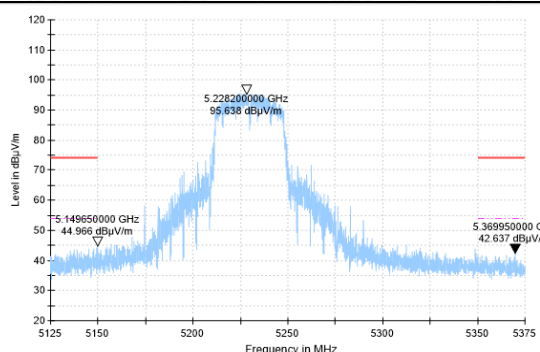
Bandedge-11N(40M)-CH38-AV



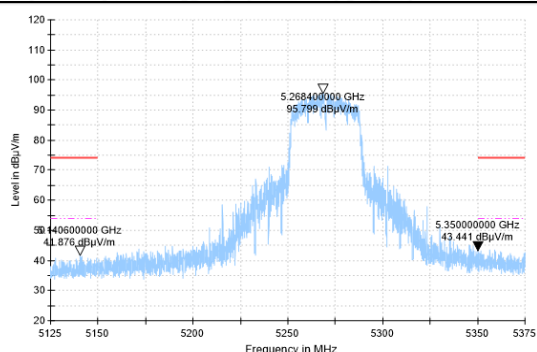
Bandedge-11N(40M)-CH38-PK



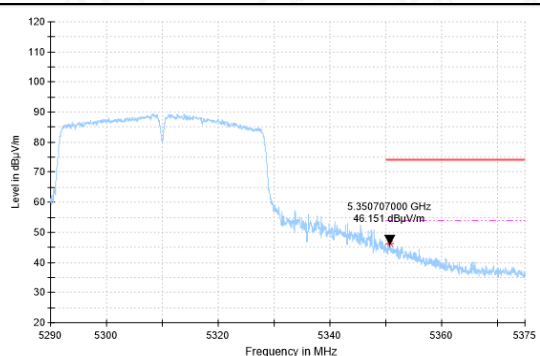
Bandedge-11N(40M)-CH46-PK



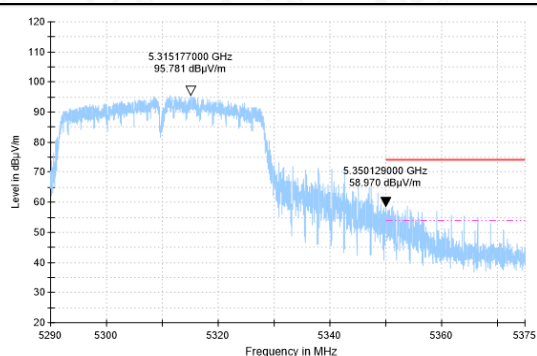
Bandedge-11N(40M)-CH54-PK

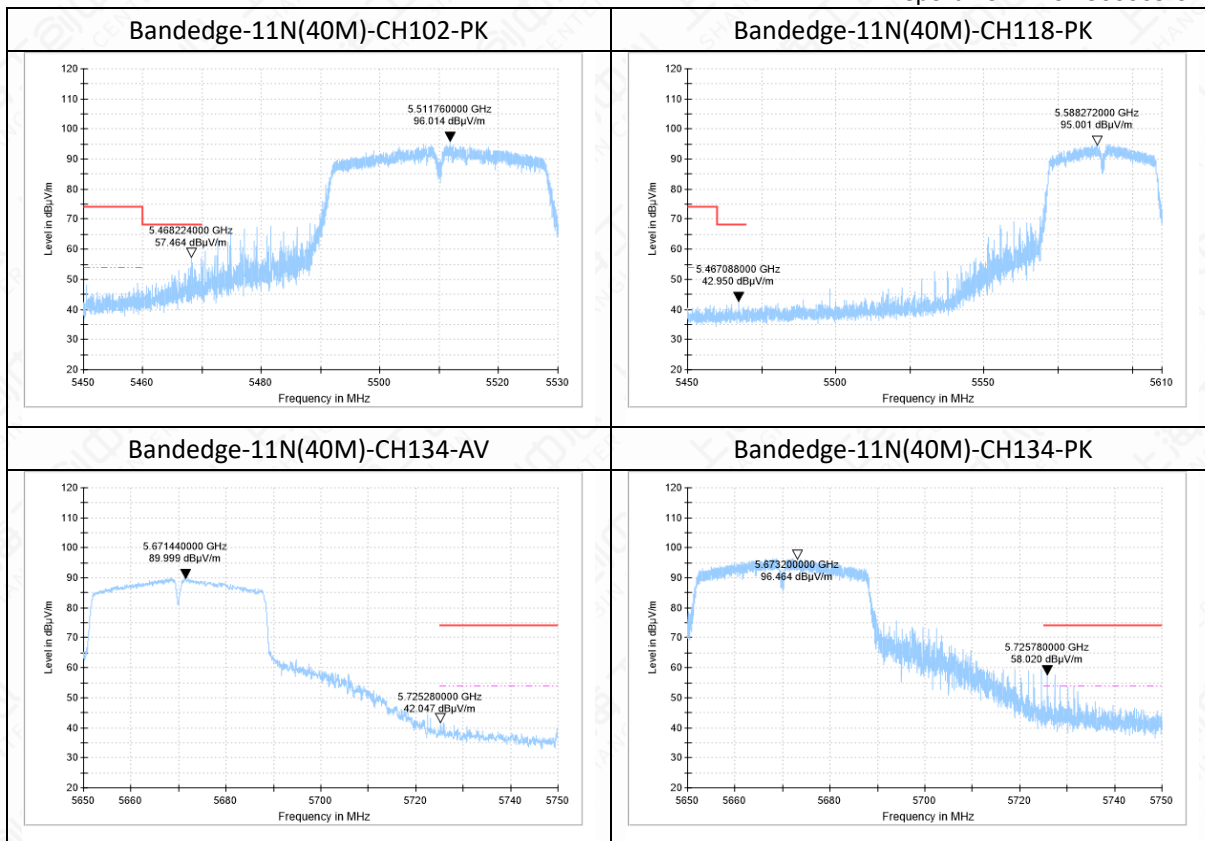


Bandedge-11N(40M)-CH62-AV



Bandedge-11N(40M)-CH62-PK





Note:

Only data in worst mode is provided.

6.7. Transmitter Spurious Emission

6.7.1 Measurement Limit

Below 1G Limit:

Frequency of emission (MHz)	Field strength(dBμV/m)	Measurement distance(m)
0.009-0.490	129-94	3
0.490-1.705	74-63	3
1.705-30	70	3
30-88	40.0	3
88-216	43.5	3
216-960	46.0	3
Above 960	54.0	3

Note: for frequency range below 960MHz, the limit in 15.209 is defined in 10m test distance. The limit used above is calculated from 10m to 3m

Above 1G, non-restricted band

Standard	EIRP Limit
15.407(b)	-27dBm/MHz

Above 1G, Restricted band

Standard	EIRP Limit	
15.407(b)	-27dBm/MHz	
15.209	Peak	74dBμV/m
	Average	54dBμV/m

$$\text{EIRP[dBm]} = \text{E[dB}\mu\text{V/m]} + 20 \log(d[\text{m}]) - 104.7$$

$$\text{E[dB}\mu\text{V/m]} = \text{EIRP[dBm]} - 20 \log(d[\text{m}]) + 104.7$$

$$\text{E[dB}\mu\text{V/m]} = \text{EIRP[dBm]} + 95.2 = 68.2, \text{ for } d = 3\text{m}$$

6.7.2 Test Procedure

The measurement is made according to KDB 789033

Set the spectrum analyzer in the following:

Procedure for Unwanted Emissions Measurements below 1000 MHz:

- Follow the requirements in II.G.3. "General Requirements for Unwanted Emissions Measurements."
- Compliance shall be demonstrated using CISPR quasi-peak detection; however, peak detection is permitted as an alternative to quasi-peak detection.

Detector: Peak and Quasi-Peak

RBW=100kHz / VBW=300kHz / Sweep=AUTO

Procedure for Unwanted Maximum Emissions Measurements above 1000 MHz:

a) Follow the requirements in II.G.3, "General Requirements for Unwanted Emissions Measurements."

b) Maximum emission levels are measured by setting the analyzer as follows:

(i) RBW = 1 MHz.

(ii) VBW $\geq$ 3 MHz.

(iii) Detector = Peak.

(iv) Sweep time = auto.

(v) Trace mode = max hold.

(vi) Allow sweeps to continue until the trace stabilizes. Note that if the transmission is not continuous, the time required for the trace to stabilize will increase by a factor of approximately $1/x$, where x is the duty cycle. For example, at 50% duty cycle, the measurement time will increase by a factor of two relative to measurement time for continuous transmission.

Procedures for Average Unwanted Emissions Measurements above 1000 MHz:

a) Follow the requirements in section II.G.3., "General Requirements for Unwanted Emissions Measurements."

b) Average emission levels shall be measured using one of the following two methods.

c) Method AD (Average Detection): Primary method

(i) RBW = 1 MHz.

(ii) VBW $\geq$ 3 MHz.

(iii) Detector = power averaging (rms), if $\text{span}/(\# \text{ of points in sweep}) \leq \text{RBW}/2$. Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, the detector mode shall be set to peak.

(iv) Averaging type = power averaging (rms)

As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used.

(v) Sweep time = auto.

(vi) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, the number of traces shall be increased by a factor of $1/x$, where x is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—rather than turning on and off with the transmit cycle, at least 100 traces shall be averaged.)

(vii) If tests are performed with the EUT transmitting at a duty cycle less than 98%, a correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:

If power averaging (rms) mode was used in step (iv) above, the correction factor is $10 \log (1/x)$, where x is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB must be added to the measured emission levels.

If linear voltage averaging mode was used in step (iv) above, the correction factor is $20 \log (1/x)$, where x is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB must be added to the measured emission levels.

If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning on and off with the transmit cycle, no duty cycle correction is required for that emission.

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. For emissions testing at or below 1 GHz, the table height shall be 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 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. Below 18GHz , the measurement antenna was placed at a distance of 3 meters from the EUT. Above 18GHz , the measurement antenna was placed at a distance of 1 meter from the EUT. During the tests, the antenna height varied from 1m to 4m and the EUT azimuth were varied from 0° to 360° 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.

Remark:

1. Factor= Antenna Factor + Cable Loss (-Amplifier, is employed)
2. Measured level= Original Receiver Reading + Factor
3. Margin = Limit – Measured level

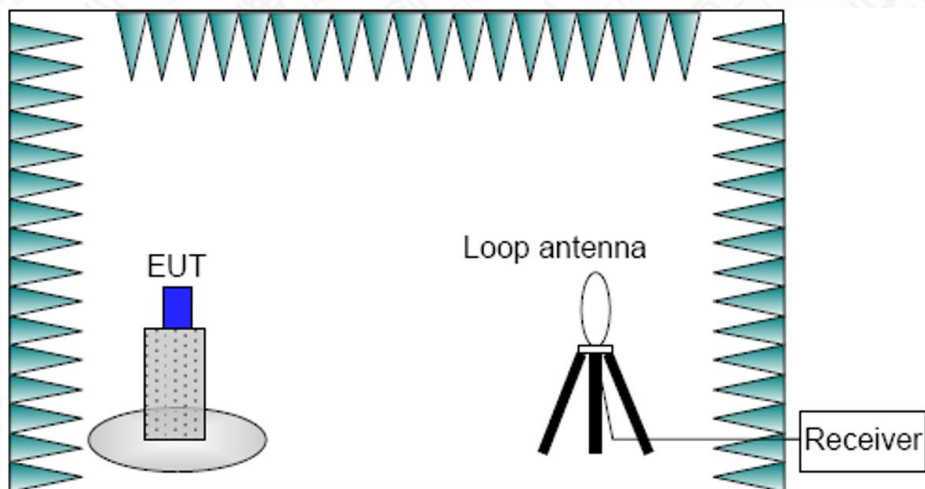
4. If the PK measured level is lower than AV limit, the AV test can be elided

Note:

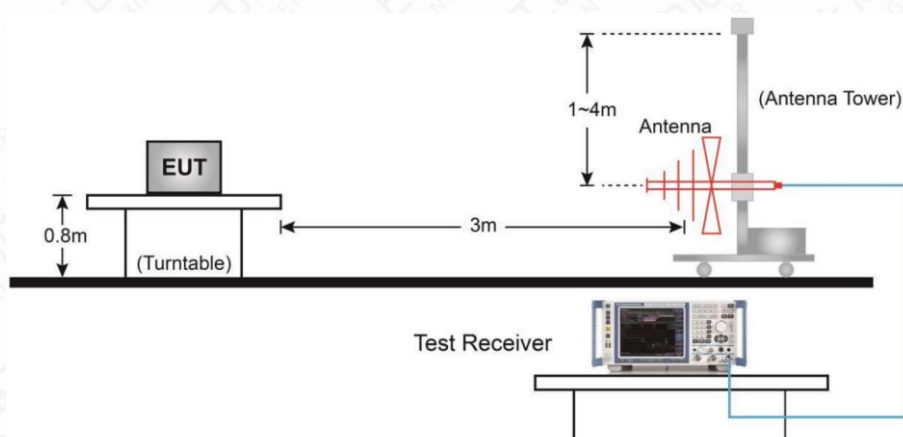
1. The out-of- limit signal in the picture is the main frequency signal.
2. Only data in worst mode is provided.
3. The test data below 30MHz is more than 20dB lower than the limit value, so it is not provided in the report.
4. Horizontal and vertical polarity is all have been tested, the result of them is synthesized in the above data diagram.

6.6.1 Test Setup

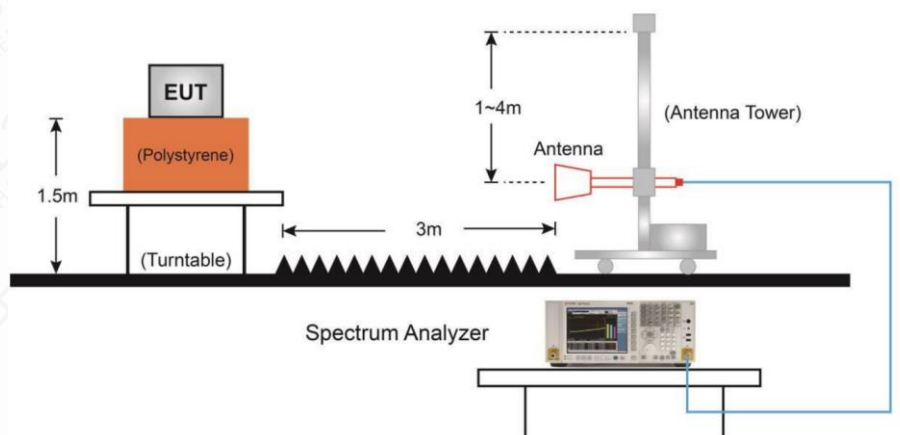
Below 30MHz Test Setup



Below 1GHz Test Setup



Above 1GHz Test Setup



6.6.2 Measurement Results

Mainly Supply (S10aa)

