TEST REPORT

Applicant Name :	CALTTA TECHNOLOGIES CO., LTD.
Address :	Floor12,Building G2,international E-City, Nanshan District, Shenzhen, China
Report Number :	SZNS220519-21600E-RF-00B
FCC ID:	2AQV7PH6X0UHF

Test Standard (s)

FCC PART 15.247

Sample Description

Product Type:	Digital Portable Radio
Model No.:	PH690 UHF
Multiple Model(s) No.:	PH660 UHF, PH600 UHF, PH690 U(1), PH660 U(1), PH600 U(1) (Please refer to DOS for Model difference)
Trade Mark:	Caltta
Date Received:	2022/05/19
Report Date:	2022/06/29

Test Result:	Pass*

* In the configuration tested, the EUT complied with the standards above.

Prepared and Checked By:

Nick Fang

EMC Engineer

Approved By:

Robert Li

EMC Engineer

Note: This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★ ".

Shenzhen Accurate Technology Co., Ltd. is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with an asterisk '*'. Customer model name, addresses, names, trademarks etc. are not considered data.

This report cannot be reproduced except in full, without prior written approval of the Company. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested. This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

TABLE OF CONTENTS

GENERAL INFORMATION **4**
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) 4
OBJECTIVE 4
TEST METHODOLOGY 4
MEASUREMENT UNCERTAINTY 5
SYSTEM TEST CONFIGURATION **6**
DESCRIPTION OF TEST CONFIGURATION 6
EQUIPMENT MODIFICATIONS 6
EUT EXERCISE SOFTWARE 6
DUTY CYCLE 7
SUPPORT EQUIPMENT LIST AND DETAILS 7
EXTERNAL I/O CABLE 7
BLOCK DIAGRAM OF TEST SETUP 7
SUMMARY OF TEST RESULTS **9**
TEST EQUIPMENT LIST **10**
FCC§15.247 (I), §1.1307 (B) (1) & §2.1093 – RF EXPOSURE **12**
APPLICABLE STANDARD 12
FCC §15.203 - ANTENNA REQUIREMENT **14**
APPLICABLE STANDARD 14
ANTENNA CONNECTOR CONSTRUCTION 14
FCC §15.207 (A) – AC LINE CONDUCTED EMISSIONS **15**
APPLICABLE STANDARD 15
EUT SETUP 15
EMI TEST RECEIVER SETUP 15
TEST PROCEDURE 15
TRANSD FACTOR & MARGIN CALCULATION 16
TEST DATA 16
FCC §15.209, §15.205 & §15.247(D) - SPURIOUS EMISSIONS **23**
APPLICABLE STANDARD 23
EUT SETUP 23
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP 24
TEST PROCEDURE 24
FACTOR & MARGIN CALCULATION 24
TEST DATA 24
FCC §15.247(A) (2) – 6 DB EMISSION BANDWIDTH & OCCUPIED BANDWIDTH **34**
APPLICABLE STANDARD 34
TEST PROCEDURE 34
TEST DATA 34
FCC §15.247(B) (3) - MAXIMUM CONDUCTED OUTPUT POWER **35**
APPLICABLE STANDARD 35
TEST PROCEDURE 35
TEST DATA 35
FCC §15.247(D) – 100 KHZ BANDWIDTH OF FREQUENCY BAND EDGE **36**

APPLICABLE STANDARD 36
TEST PROCEDURE 36
TEST DATA 36

FCC §15.247(E) - POWER SPECTRAL DENSITY.....37

APPLICABLE STANDARD 37
TEST PROCEDURE 37
TEST DATA 37

APPENDIX 38

APPENDIX A: DTS BANDWIDTH 38
APPENDIX B: OCCUPIED CHANNEL BANDWIDTH 40
APPENDIX C: MAXIMUM CONDUCTED PEAK OUTPUT POWER.....42
APPENDIX D: MAXIMUM POWER SPECTRAL DENSITY.....44
APPENDIX E:BAND EDGE MEASUREMENTS 46
APPENDIX F: DUTY CYCLE 47

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Frequency Range	BLE:2402-2480MHz
Maximum Conducted Peak Output Power	BLE:2.61dBm
Modulation Technique	BLE:GFSK
Antenna Specification*	-4.0dBi (provided by the applicant)
Voltage Range	DC 7.4V from battery or DC 12.0V from adapter
Sample serial number	Model: PH690 UHF SZNS220519-21600E-RF-S3 Model: PH600 U(1) SZNS220519-21600E-RF-S2 Model: PH660 U(1) SZNS220519-21600E-RF-S1 (Assigned by ATC)
Sample/EUT Status	Good condition
Adapter 1 information	Model: ES085H-X120100XYF Input: AC 100-240V, 50/60Hz, 0.5A Output: DC 12.0V, 1.0A

Objective

This test report is in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commission's rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

And KDB 558074 D01 15.247 Meas Guidance v05r02.

All emissions measurement was performed at Shenzhen Accurate Technology Co., Ltd. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Each test item follows test standards and with no deviation.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		5%
RF Frequency		$0.082*10^{-7}$
RF output power, conducted		0.73dB
Unwanted Emission, conducted		1.6dB
AC Power Lines Conducted Emissions		2.72dB
Emissions, Radiated	9kHz - 30MHz	2.66dB
	30MHz - 1GHz	4.28dB
	1GHz - 18GHz	4.98dB
	18GHz - 26.5GHz	5.06dB
	26.5GHz - 40GHz	4.72dB
Temperature		1℃
Humidity		6%
Supply voltages		0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The test site used by Shenzhen Accurate Technology Co., Ltd. to collect test data is located on the 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 708358, the FCC Designation No.: CN1189. Accredited by American Association for Laboratory Accreditation (A2LA) The Certificate Number is 429 7.01.

Listed by Innovation, Science and Economic Development Canada (ISEDC), the Registration Number is 5077A.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

For BLE mode, 40 channels are provided to testing:

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

EUT was tested with Channel 0, 19 and 39.

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

"CyBluetool.exe"* software was used to test and power level as below:

Mode	Data Rate	Power Level
BLE	1Mbps	Default

The software and power level was provided by the applicant.

Duty cycle

Test Result: Compliant. Please refer to the Appendix.

Support Equipment List and Details

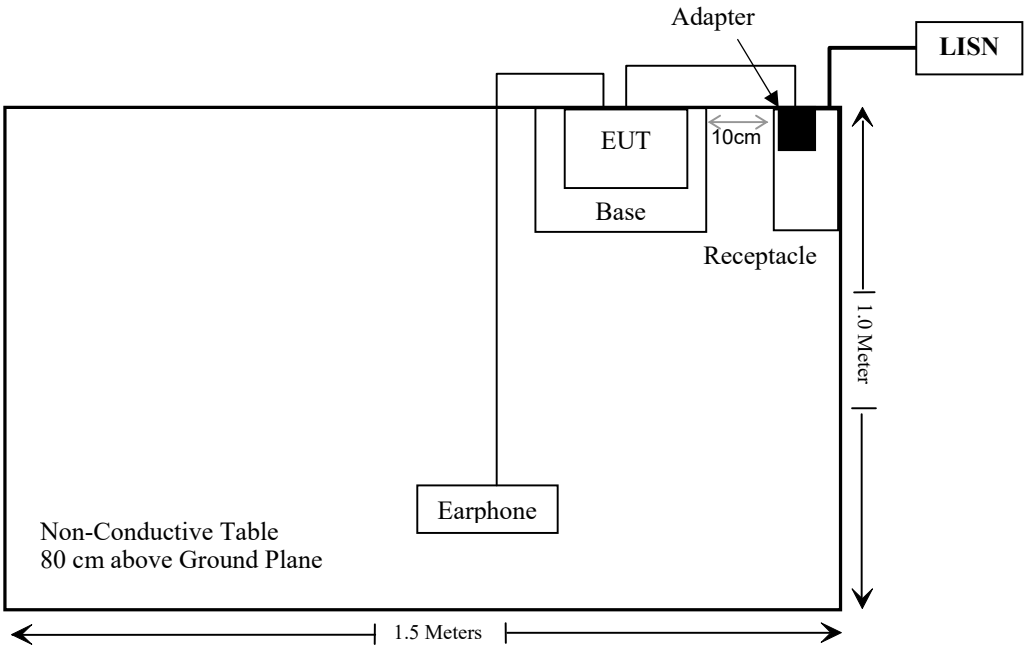
Manufacturer	Description	Model	Serial Number
/	/	/	/

External I/O Cable

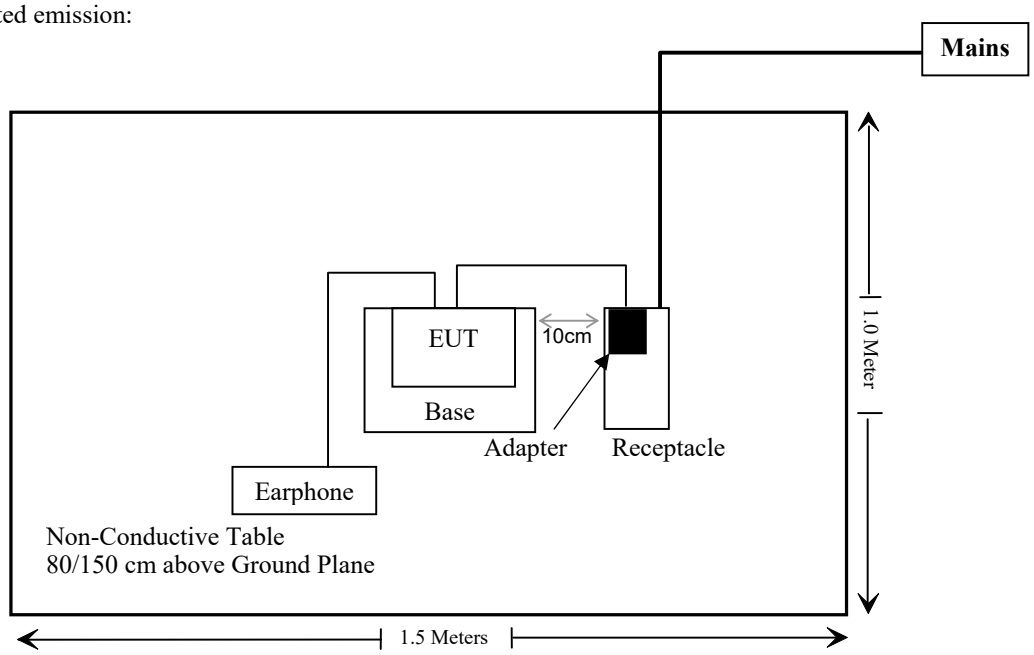
Cable Description	Length (m)	From Port	To
Un-shield Un-Detachable DC Cable	1.2	Adapter	Base

Block Diagram of Test Setup

For conducted emission:



For radiated emission:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i), §1.1307 (b) (1) & §2.1093	RF Exposure	Compliant
§15.203	Antenna Requirement	Compliant
§15.207 (a)	AC Line Conducted Emissions	Compliant
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliant
§15.247 (a)(2)	6 dB Emission Bandwidth & Occupied Bandwidth	Compliant
§15.247(b)(3)	Maximum Conducted Output Power	Compliant
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247(e)	Power Spectral Density	Compliant

Note 1: The multiple models are electrically identical with the Model:PH690 UHF. Please refer to the declaration letter for more details, which was provided by the applicant. Fully test was performed with Model:PH690 UHF except radiation emission below 1GHz and AC line conducted emission test with Model: PH690 UHF, PH600 U(1), PH660 U(1).

Note 2: The EUT has two battery which the model is AB610 and AB660, pre-scan with the two battery, the worst case is the model AB660 which was recorded in the report.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emissions Test					
Rohde& Schwarz	EMI Test Receiver	ESCI	100784	2021/12/13	2022/12/12
Rohde & Schwarz	L.I.S.N.	ENV216	101314	2021/12/13	2022/12/12
Anritsu Corp	50 Coaxial Switch	MP59B	6100237248	2021/12/13	2022/12/12
Unknown	RF Coaxial Cable	No.17	N0350	2021/12/14	2022/12/13
Conducted Emission Test Software: e3 19821b (V9)					
Radiated Emissions Test					
Rohde& Schwarz	Test Receiver	ESR	102725	2021/12/13	2022/12/12
Rohde&Schwarz	Spectrum Analyzer	FSV40	101949	2021/12/13	2022/12/12
SONOMA INSTRUMENT	Amplifier	310 N	186131	2021/11/09	2022/11/08
A.H. Systems, inc.	Preamplifier	PAM-0118P	135	2021/11/09	2022/11/08
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2021/11/11	2022/11/10
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2021/07/06	2024/07/05
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2020/01/05	2023/01/04
Schwarzbeck	HORN ANTENNA	BBHA9170	9170-359	2020/01/05	2023/01/04
Radiated Emission Test Software: e3 19821b (V9)					
Unknown	RF Coaxial Cable	No.10	N050	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.11	N1000	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.12	N040	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.13	N300	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.14	N800	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.15	N600	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.16	N650	2021/12/14	2022/12/13
Wainwright	High Pass Filter	WHKX3.6/18 G-10SS	5	2021/12/14	2022/12/13

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Rohde&Schwarz	Spectrum Analyzer	FSV-40	101590	2022/01/19	2023/01/18
Tonscend	RF Control Unit	JS0806-2	19G8060182	2021/10/26	2022/10/25
Unknown	RF Coaxial Cable	No.31	RF-01	Each time	
Unknown	RF Cable	Unknown	2	Each time	

*** Statement of Traceability:** Shenzhen Accurate Technology Co., Ltd. attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC§15.247 (i), §1.1307 (b) (1) & §2.1093 – RF EXPOSURE

Applicable Standard

According to FCC §2.1093 and §1.1307(b) (3), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB 447498 D04 Interim General RF Exposure Guidance

SAR-Based Exemption:

SAR-based thresholds are derived based on frequency, power, and separation distance of the RF source. The formula defines the thresholds in general for either available maximum timeaveraged power or maximum time-averaged ERP, whichever is greater.

Per § 1.1307(b)(3)(i)(B), for single RF sources (i.e., any single fixed RF source, mobile device, or portable device, as defined in paragraph (b)(2) of this section): A single RF source is exempt if:

the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P_{th} (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by:

$$P_{th}\ (\text{mW}) = \begin{cases} ERP_{20\ cm}(d/20\ \text{cm})^x & d \le 20\ \text{cm} \\ ERP_{20\ cm} & 20\ \text{cm} < d \le 40\ \text{cm} \end{cases}$$

Where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\ cm}\sqrt{f}}\right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20\ cm}\ (\text{mW}) = \begin{cases} 2040f & 0.3\ \text{GHz} \le f < 1.5\ \text{GHz} \\ 3060 & 1.5\ \text{GHz} \le f \le 6\ \text{GHz} \end{cases}$$

d = the separation distance (cm);

For worst case:

Exemption limit:

For f=2.48GHz, d=2.0cm, the P_{th}=38.0mW

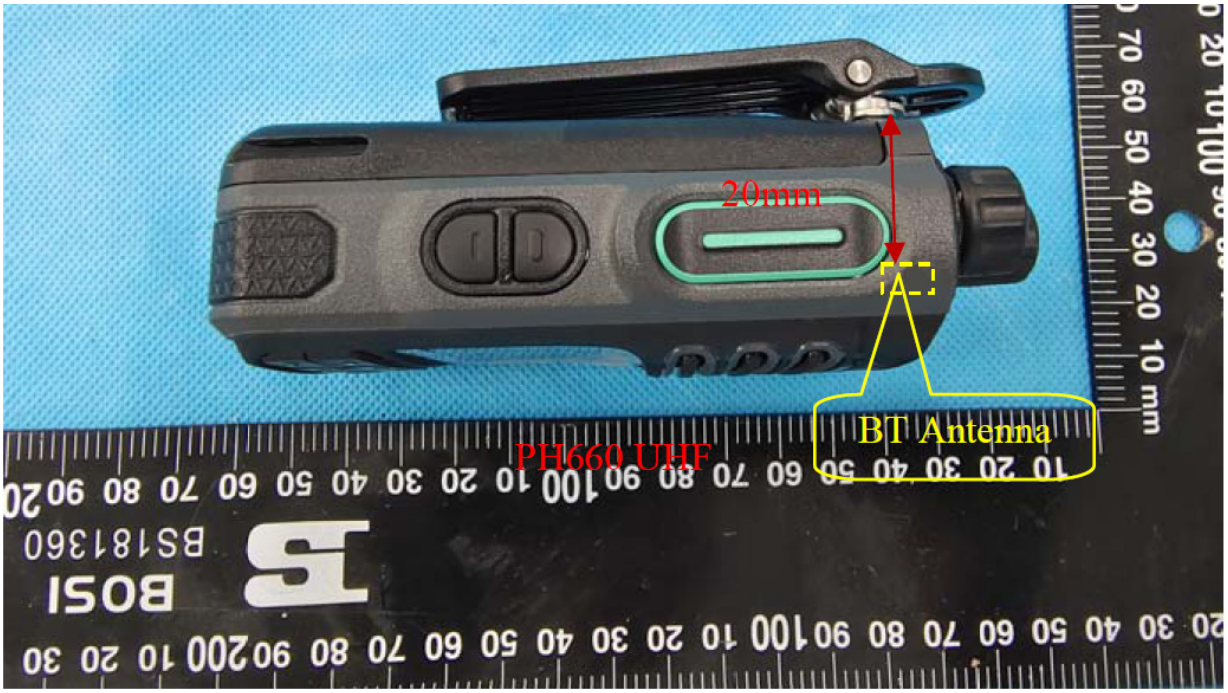
The maximum tune-up conducted power is 3.0dBm (2.0mW)

The antenna gain is -4.0dBi(-6.15dBd)

The ERP is 3.0dBm-6.15dBd=-3.15dBm(0.48mW)

So the higher of the available maximum time-averaged power or effective radiated power (ERP) is 2.0mW which less than 38mW@2480MHz exemption limit.

So the stand-alone SAR evaluation can be exempted.



FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

a. Antenna must be permanently attached to the unit.
b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.
And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

The EUT has one internal antenna arrangement which was permanently attached and the antenna gain is -4.0dBi, fulfill the requirement of this section. Please refer to the EUT photos.

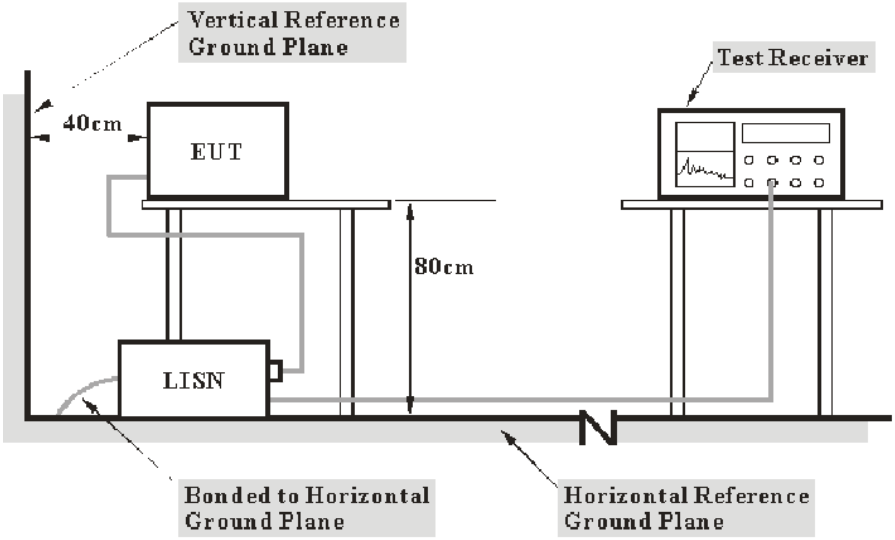
Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All final data was recorded in the Quasi-peak and average detection mode.

Transd Factor & Margin Calculation

The Transd factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss. The basic equation is as follows:

Factor = LISN VDF + Cable Loss

The "**Over Limit**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a over limit of -7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

Over Limit = level – Limit
Level= reading level+ Factor

Test Data

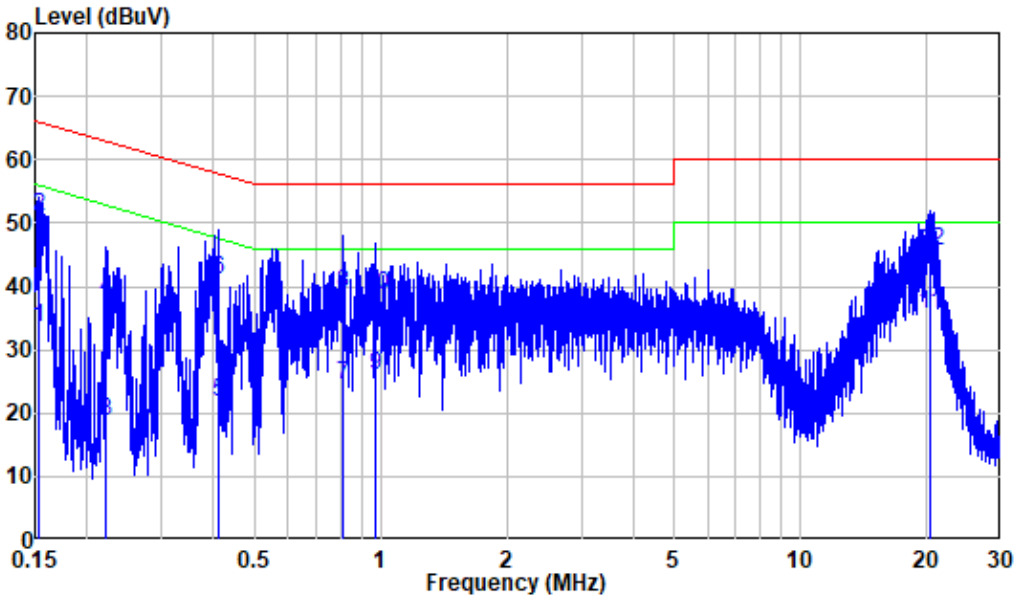
Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	51 %
ATM Pressure:	101.0 kPa

The testing was performed by Jason Liu on 2022-06-23.

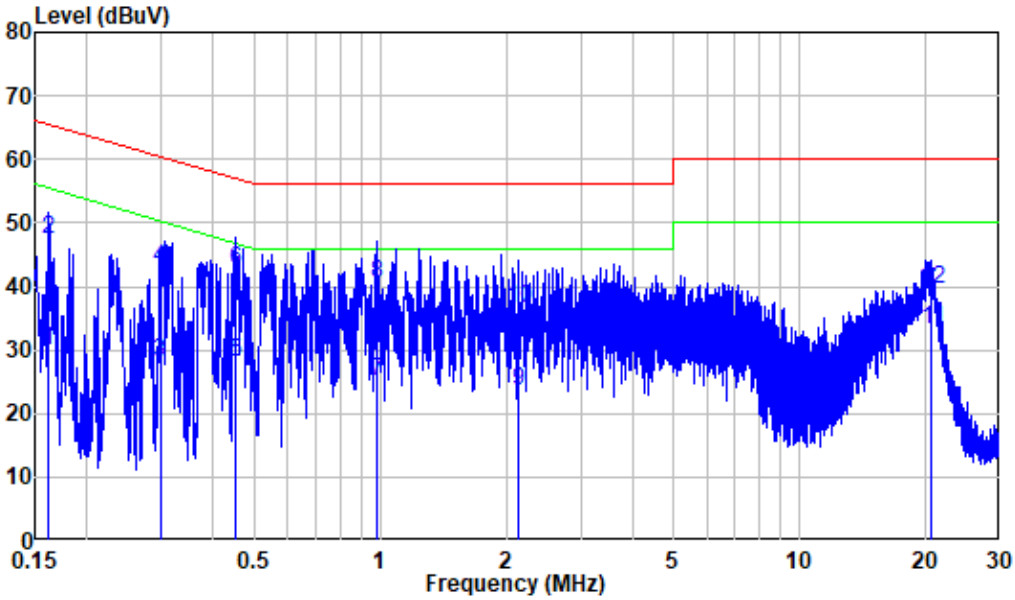
EUT operation mode: Transmitting (the worst case for High channel)

Model: PH690 UHF
AC 120V/60 Hz, Line



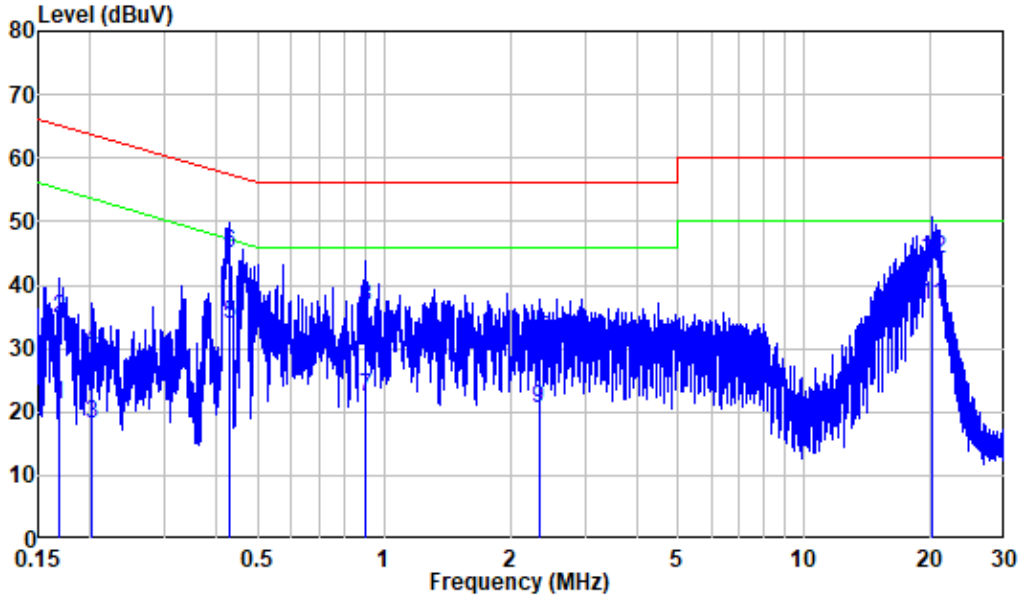
	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.153	9.80	23.78	33.58	55.86	-22.28	Average
2	0.153	9.80	41.21	51.01	65.86	-14.85	QP
3	0.221	9.80	8.97	18.77	52.80	-34.03	Average
4	0.221	9.80	28.14	37.94	62.80	-24.86	QP
5	0.412	9.80	11.94	21.74	47.61	-25.87	Average
6	0.412	9.80	31.26	41.06	57.61	-16.55	QP
7	0.813	9.81	14.63	24.44	46.00	-21.56	Average
8	0.813	9.81	29.04	38.85	56.00	-17.15	QP
9	0.974	9.81	16.12	25.93	46.00	-20.07	Average
10	0.974	9.81	28.86	38.67	56.00	-17.33	QP
11	20.270	10.00	25.60	35.60	50.00	-14.40	Average
12	20.270	10.00	35.54	45.54	60.00	-14.46	QP

AC 120V/60 Hz, Neutral



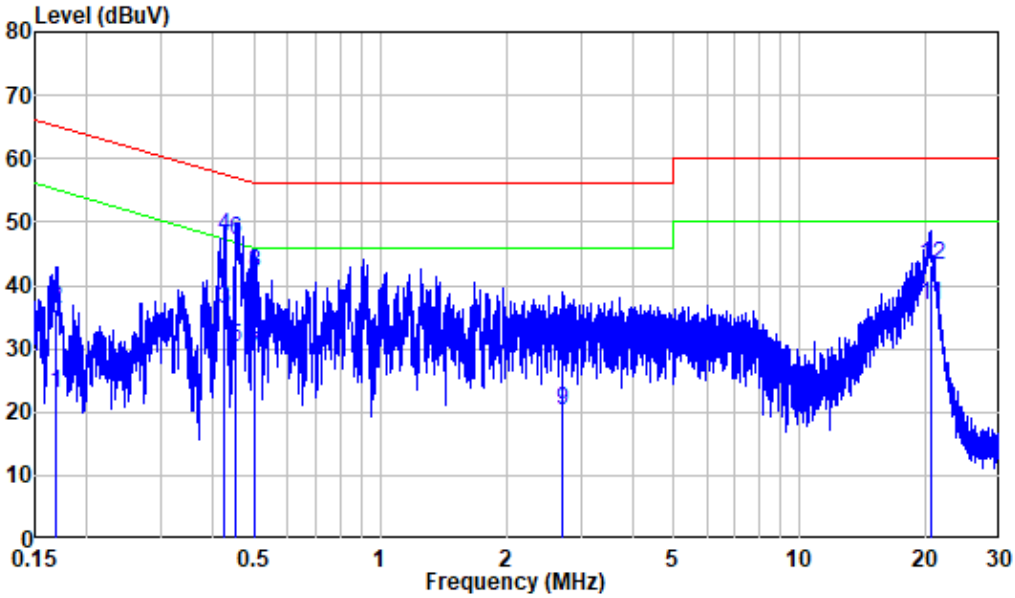
	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.162	9.80	20.02	29.82	55.38	-25.56	Average
2	0.162	9.80	37.45	47.25	65.38	-18.13	QP
3	0.298	9.80	18.19	27.99	50.29	-22.30	Average
4	0.298	9.80	33.17	42.97	60.29	-17.32	QP
5	0.453	9.80	18.38	28.18	46.82	-18.64	Average
6	0.453	9.80	32.65	42.45	56.82	-14.37	QP
7	0.979	9.81	15.26	25.07	46.00	-20.93	Average
8	0.979	9.81	30.56	40.37	56.00	-15.63	QP
9	2.130	9.82	13.59	23.41	46.00	-22.59	Average
10	2.130	9.82	26.72	36.54	56.00	-19.46	QP
11	20.622	10.11	23.22	33.33	50.00	-16.67	Average
12	20.622	10.11	29.43	39.54	60.00	-20.46	QP

Model: PH600 U(1)
AC 120V/60 Hz, Line



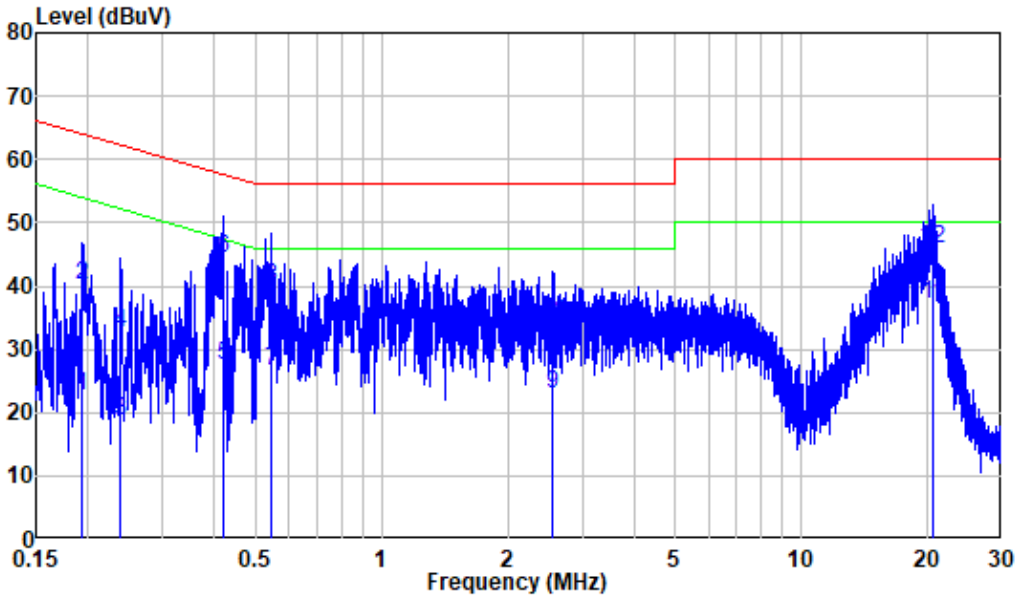
	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.168	9.80	11.30	21.10	55.06	-33.96	Average
2	0.168	9.80	24.82	34.62	65.06	-30.44	QP
3	0.201	9.80	8.20	18.00	53.57	-35.57	Average
4	0.201	9.80	20.23	30.03	63.57	-33.54	QP
5	0.427	9.80	23.94	33.74	47.31	-13.57	Average
6	0.427	9.80	35.23	45.03	57.31	-12.28	QP
7	0.901	9.81	12.55	22.36	46.00	-23.64	Average
8	0.901	9.81	26.65	36.46	56.00	-19.54	QP
9	2.332	9.82	10.71	20.53	46.00	-25.47	Average
10	2.332	9.82	21.59	31.41	56.00	-24.59	QP
11	20.109	10.00	26.94	36.94	50.00	-13.06	Average
12	20.109	10.00	34.20	44.20	60.00	-15.80	QP

AC 120V/60 Hz, Neutral



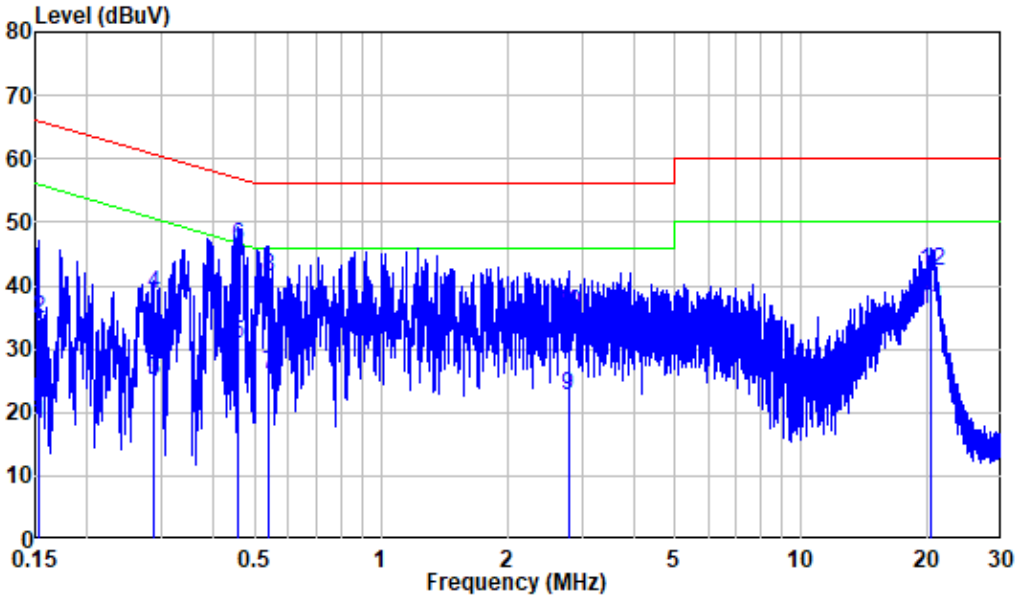
	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.169	9.80	13.04	22.84	55.00	-32.16	Average
2	0.169	9.80	26.58	36.38	65.00	-28.62	QP
3	0.425	9.80	26.53	36.33	47.36	-11.03	Average
4	0.425	9.80	37.80	47.60	57.36	-9.76	QP
5	0.453	9.80	20.44	30.24	46.81	-16.57	Average
6	0.453	9.80	37.26	47.06	56.81	-9.75	QP
7	0.501	9.80	19.31	29.11	46.00	-16.89	Average
8	0.501	9.80	32.29	42.09	56.00	-13.91	QP
9	2.709	9.83	10.52	20.35	46.00	-25.65	Average
10	2.709	9.83	21.83	31.66	56.00	-24.34	QP
11	20.594	10.11	26.85	36.96	50.00	-13.04	Average
12	20.594	10.11	32.95	43.06	60.00	-16.94	QP

Model: PH660 U(1)
AC 120V/60 Hz, Line



	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.194	9.80	12.69	22.49	53.87	-31.38	Average
2	0.194	9.80	30.33	40.13	63.87	-23.74	QP
3	0.239	9.80	8.90	18.70	52.14	-33.44	Average
4	0.239	9.80	22.76	32.56	62.14	-29.58	QP
5	0.418	9.80	17.77	27.57	47.50	-19.93	Average
6	0.418	9.80	34.60	44.40	57.50	-13.10	QP
7	0.548	9.81	16.64	26.45	46.00	-19.55	Average
8	0.548	9.81	30.14	39.95	56.00	-16.05	QP
9	2.562	9.83	13.23	23.06	46.00	-22.94	Average
10	2.562	9.83	24.37	34.20	56.00	-21.80	QP
11	20.458	10.00	27.23	37.23	50.00	-12.77	Average
12	20.458	10.00	35.85	45.85	60.00	-14.15	QP

AC 120V/60 Hz, Neutral



	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.153	9.80	8.25	18.05	55.86	-37.81	Average
2	0.153	9.80	24.83	34.63	65.86	-31.23	QP
3	0.287	9.80	15.26	25.06	50.61	-25.55	Average
4	0.287	9.80	28.91	38.71	60.61	-21.90	QP
5	0.456	9.80	21.09	30.89	46.76	-15.87	Average
6	0.456	9.80	36.39	46.19	56.76	-10.57	QP
7	0.540	9.81	16.08	25.89	46.00	-20.11	Average
8	0.540	9.81	31.40	41.21	56.00	-14.79	QP
9	2.787	9.83	12.84	22.67	46.00	-23.33	Average
10	2.787	9.83	25.80	35.63	56.00	-20.37	QP
11	20.377	10.10	26.25	36.35	50.00	-13.65	Average
12	20.377	10.10	32.14	42.24	60.00	-17.76	QP

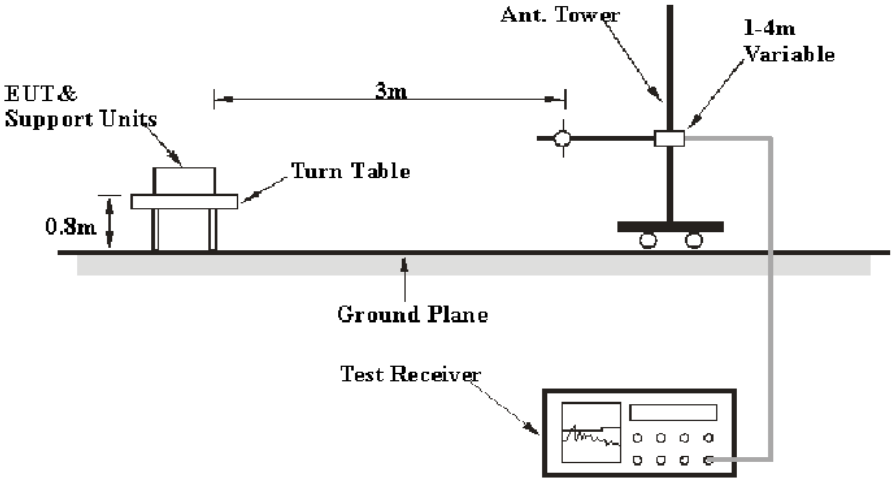
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

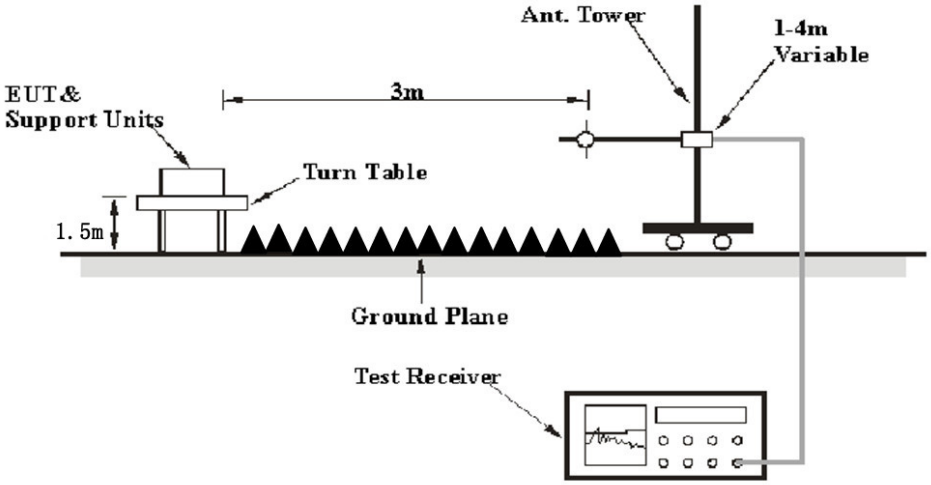
FCC §15.247 (d); §15.209; §15.205;

EUT Setup

Below 1 GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

EMI Test Receiver & Spectrum Analyzer Setup

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz Note 1	/	Average
	1MHz	＞1/T Note 2	/	Average

Note 1: when duty cycle is no less than 98%
Note 2: when duty cycle is less than 98%

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1 GHz, peak and Average detection modes for frequencies above 1 GHz.

Factor & Margin Calculation

The Factor is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain. The basic equation is as follows:

Factor = Antenna Factor + Cable Loss - Amplifier Gain

The "**Over Limit/Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, an Over Limit/margin of -7dB means the emission is 7dB below the limit. The equation for calculation is as follows:

Over Limit/Margin = Level / Corrected Amplitude – Limit
Level / Corrected Amplitude = Read Level + Factor

Test Data

Environmental Conditions

Temperature:	25.6~31℃
Relative Humidity:	50~55 %
ATM Pressure:	101.0 kPa

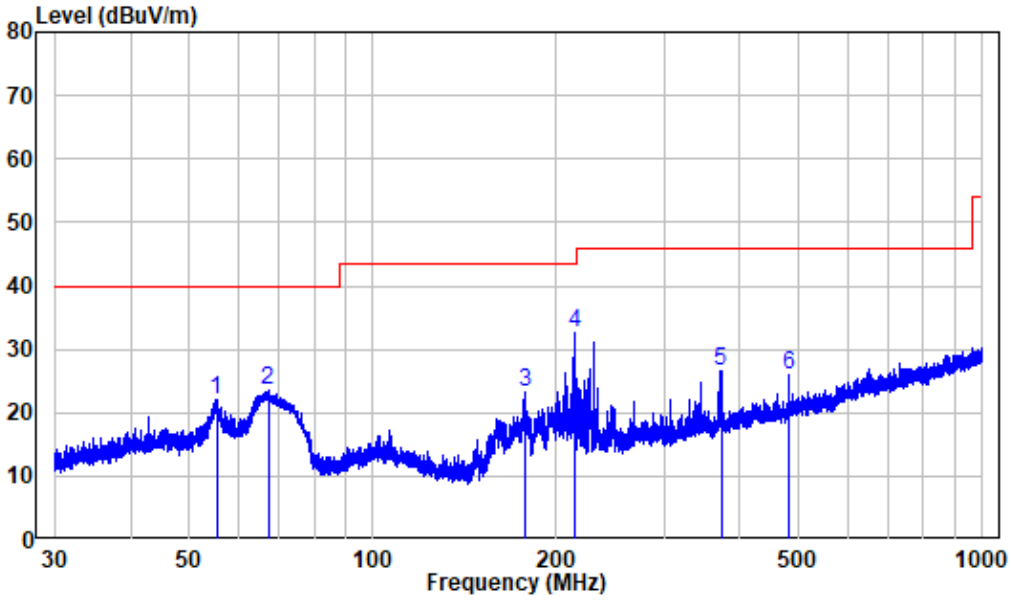
The testing was performed by Level Li on 2022-06-27 for below 1GHz, Level Li and Nick Fang on 2022-06-24 and 2022-06-27 for above 1GHz.

EUT operation mode: Transmitting (Pre-scan in the X,Y and Z axes of orientation, the worst case Y-axis of orientation was recorded)

30MHz-1GHz: *(worst case is High channel)*
Note: When the test result of peak was less than the limit of QP more than 6dB, just peak value were recorded.

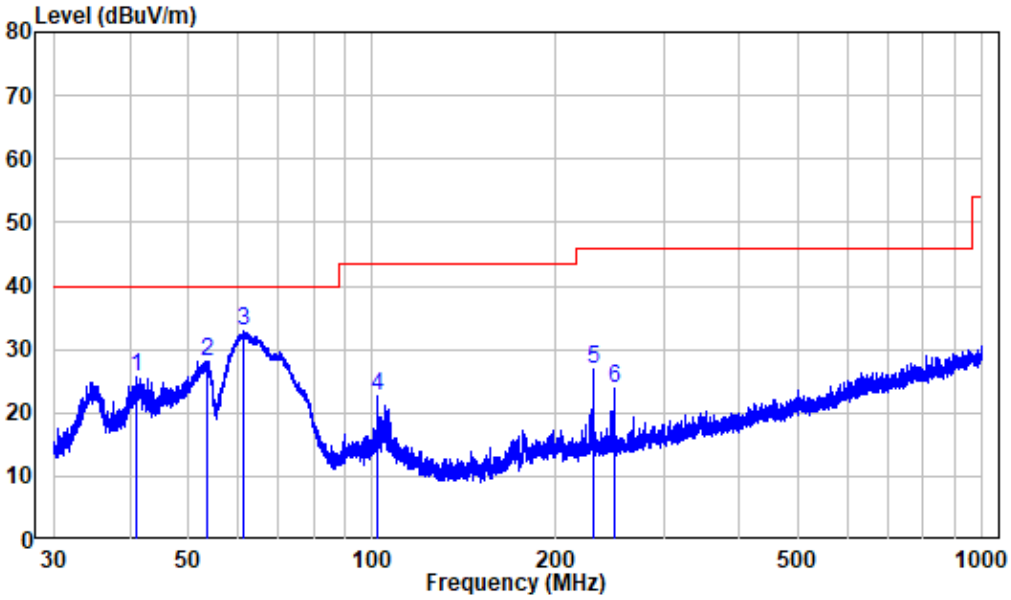
Model: PH690 UHF

Horizontal:



	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	55.342	-10.25	32.21	21.96	40.00	-18.04	Peak
2	67.261	-13.48	36.93	23.45	40.00	-16.55	Peak
3	177.587	-12.99	36.29	23.30	43.50	-20.20	Peak
4	214.891	-11.68	44.35	32.67	43.50	-10.83	Peak
5	372.494	-7.29	33.94	26.65	46.00	-19.35	Peak
6	480.107	-5.00	31.09	26.09	46.00	-19.91	Peak

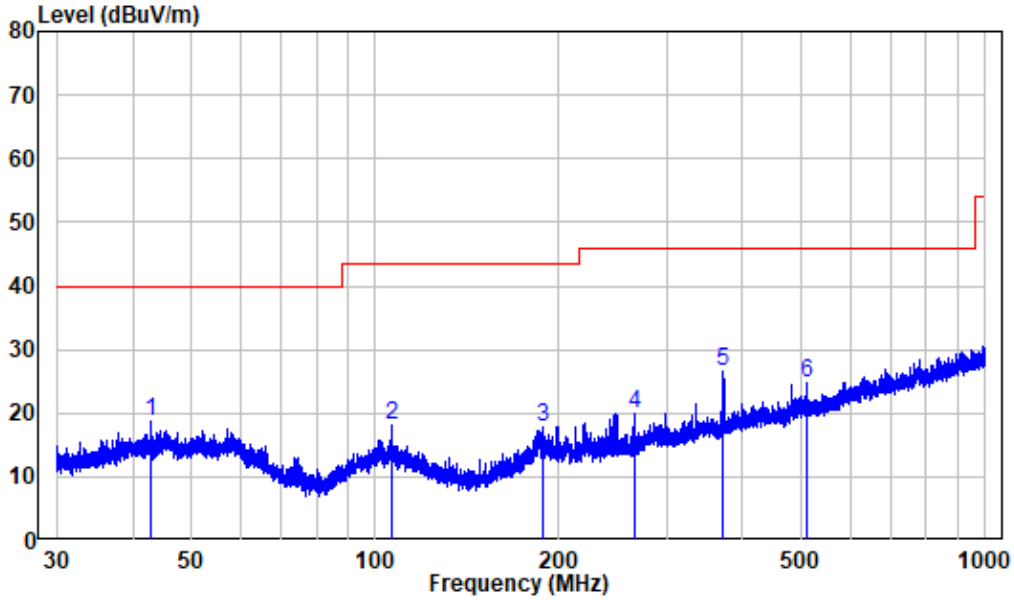
Vertical



	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	41.114	-10.16	35.82	25.66	40.00	-14.34	Peak
2	53.505	-10.26	38.49	28.23	40.00	-11.77	Peak
3	61.535	-11.25	44.14	32.89	40.00	-7.11	Peak
4	101.867	-11.58	34.10	22.52	43.50	-20.98	Peak
5	230.401	-11.09	38.10	27.01	46.00	-18.99	Peak
6	249.097	-10.71	34.69	23.98	46.00	-22.02	Peak

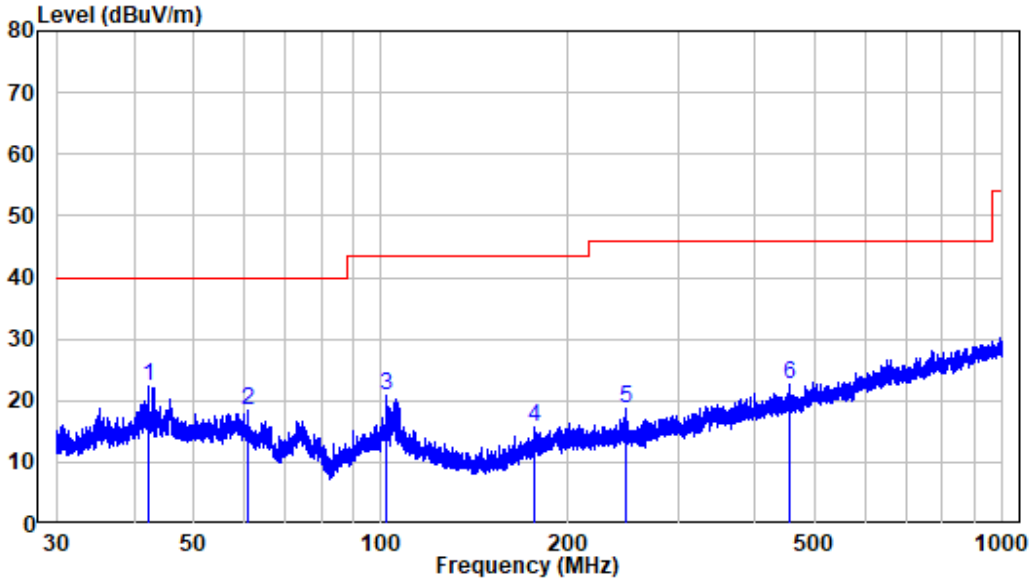
Model: PH600 U(1)

Horizontal:



	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	42.956	-9.96	28.64	18.68	40.00	-21.32	Peak
2	106.665	-11.94	30.08	18.14	43.50	-25.36	Peak
3	188.247	-11.80	29.62	17.82	43.50	-25.68	Peak
4	266.609	-10.38	30.28	19.90	46.00	-26.10	Peak
5	372.168	-7.29	33.74	26.45	46.00	-19.55	Peak
6	510.715	-4.27	29.06	24.79	46.00	-21.21	Peak

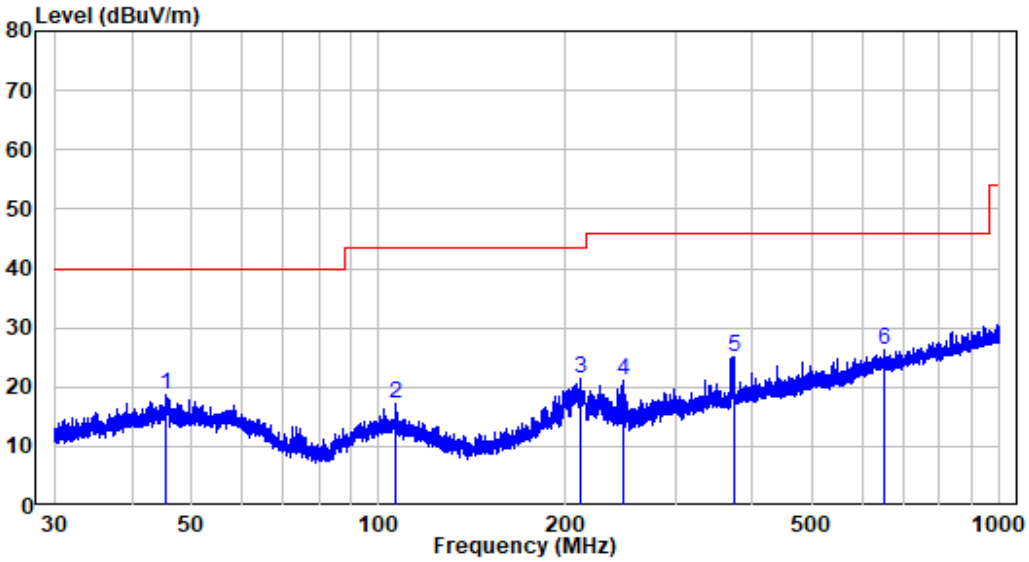
Vertical



	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	42.080	-10.02	32.23	22.21	40.00	-17.79	Peak
2	61.105	-11.07	29.41	18.34	40.00	-21.66	Peak
3	101.912	-11.58	32.52	20.94	43.50	-22.56	Peak
4	176.810	-13.03	28.76	15.73	43.50	-27.77	Peak
5	247.140	-10.66	29.41	18.75	46.00	-27.25	Peak
6	455.107	-5.51	28.25	22.74	46.00	-23.26	Peak

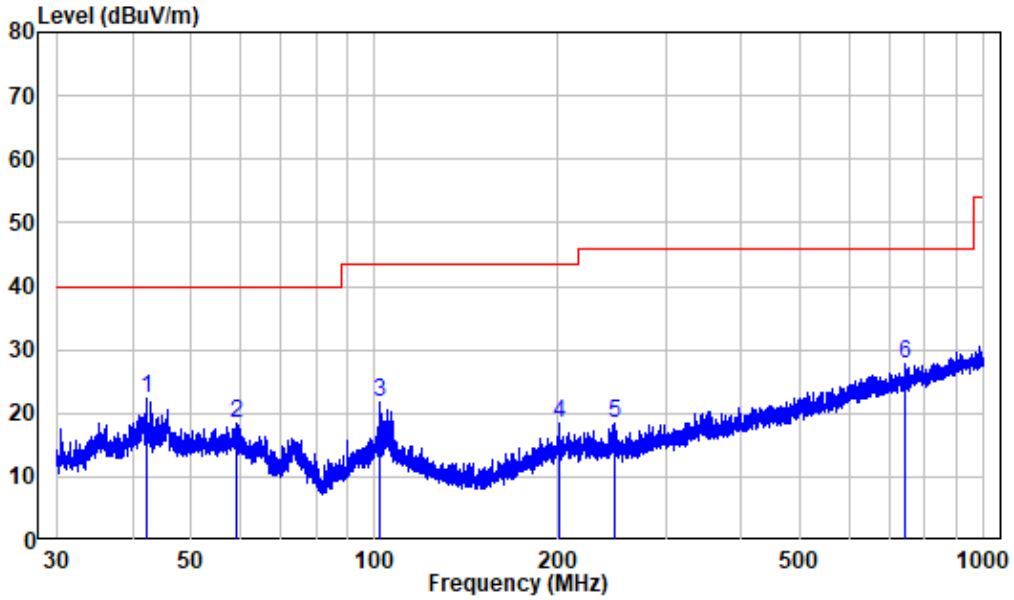
Model: PH660 U(1)

Horizontal:



	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	45.276	-9.95	28.57	18.62	40.00	-21.38	Peak
2	106.712	-11.95	29.19	17.24	43.50	-26.26	Peak
3	211.249	-11.81	33.34	21.53	43.50	-21.97	Peak
4	247.356	-10.65	31.88	21.23	46.00	-24.77	Peak
5	372.821	-7.29	32.29	25.00	46.00	-21.00	Peak
6	650.515	-1.71	27.87	26.16	46.00	-19.84	Peak

Vertical



	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	42.080	-10.02	32.51	22.49	40.00	-17.51	Peak
2	59.388	-10.40	28.68	18.28	40.00	-21.72	Peak
3	101.912	-11.58	33.28	21.70	43.50	-21.80	Peak
4	200.952	-11.49	29.83	18.34	43.50	-25.16	Peak
5	248.443	-10.69	29.20	18.51	46.00	-27.49	Peak
6	744.540	-0.87	28.53	27.66	46.00	-18.34	Peak

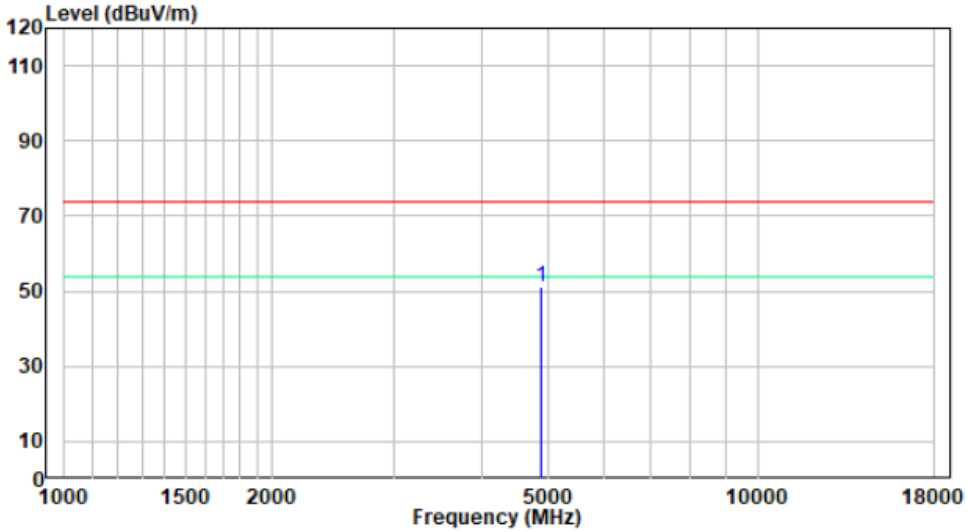
1-25 GHz: *(the worst case is model: PH690 UHF)*

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/QP/AV		Height (m)	Polar (H/V)				
Low Channel(2402MHz)									
2310	67.71	PK	4	1.8	H	-7.24	60.47	74	-13.53
2310	54.58	AV	4	1.8	H	-7.24	47.34	54	-6.66
2390	67.9	PK	137	1.9	H	-7.22	60.68	74	-13.32
2390	55.58	AV	137	1.9	H	-7.22	48.36	54	-5.64
2310	67.64	PK	47	2.5	V	-7.24	60.40	74	-13.60
2310	54.72	AV	47	2.5	V	-7.24	47.48	54	-6.52
2390	68.22	PK	340	1.5	V	-7.22	61.00	74	-13.00
2390	55.66	AV	340	1.5	V	-7.22	48.44	54	-5.56
4804	52.87	PK	313	1.9	H	-3.51	49.36	74	-24.64
4804	52.56	PK	111	1.1	V	-3.51	49.05	74	-24.95
Middle Channel(2440MHz)									
4880	54.53	PK	208	2	H	-3.38	51.15	74	-22.85
4880	53.76	PK	198	2.1	V	-3.38	50.38	74	-23.62
High Channel(2480MHz)									
2483.5	69.61	PK	3	2.4	H	-7.2	62.41	74	-11.59
2483.5	56.28	AV	3	2.4	H	-7.2	49.08	54	-4.92
2500	69	PK	222	1.5	H	-7.18	61.82	74	-12.18
2500	55.9	AV	222	1.5	H	-7.18	48.72	54	-5.28
2483.5	69.47	PK	288	2.5	V	-7.2	62.27	74	-11.73
2483.5	55.91	AV	288	2.5	V	-7.2	48.71	54	-5.29
2500	68.99	PK	203	2.1	V	-7.18	61.81	74	-12.19
2500	55.67	AV	203	2.1	V	-7.18	48.49	54	-5.51
4960	52.02	PK	75	1.4	H	-3.01	49.01	74	-24.99
4960	53.43	PK	211	2.1	V	-3.01	50.42	74	-23.58

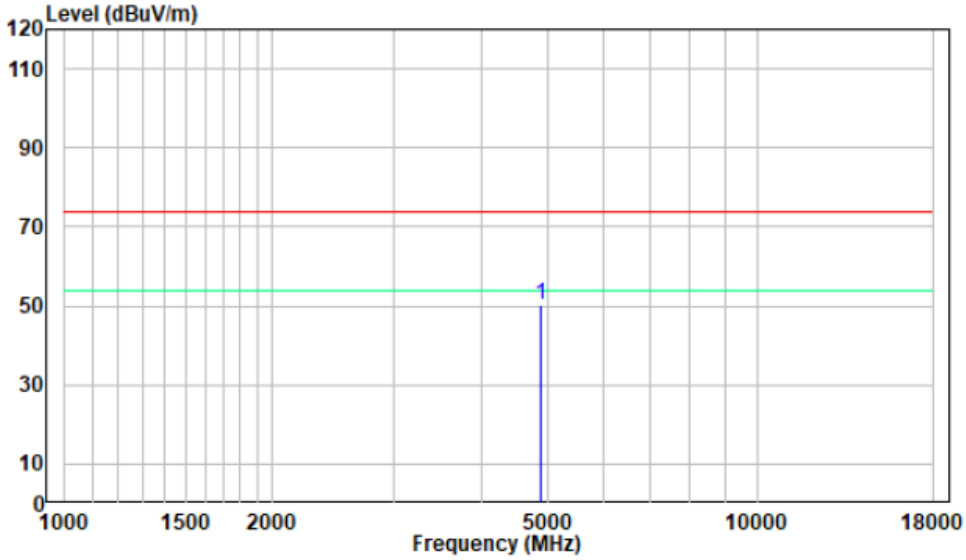
Note:
Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Corrected Amplitude = Corrected Factor + Reading
Margin = Corrected. Amplitude - Limit
The other spurious emission which is in the noise floor level was not recorded.

1-18 GHz:

Pre-scan for
Middle Channel
Horizontal

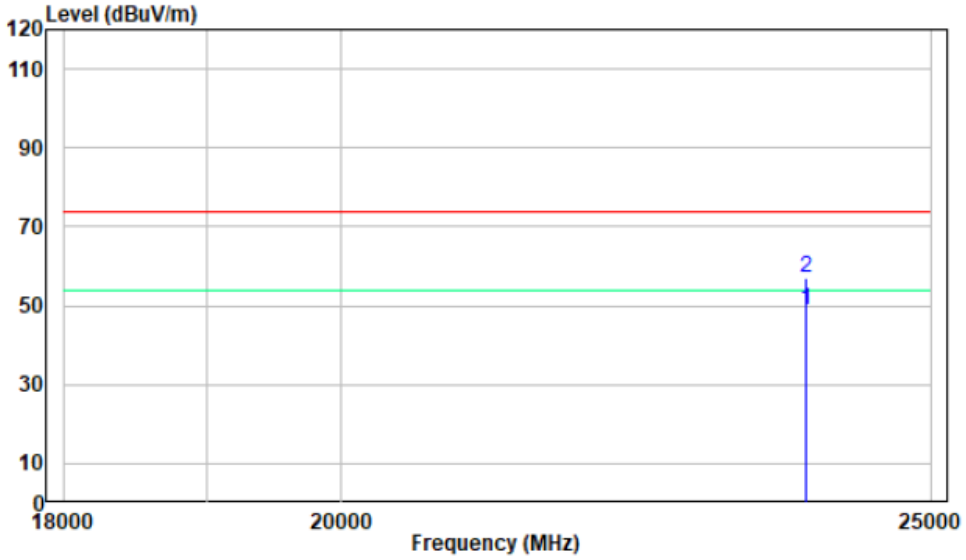


Vertical

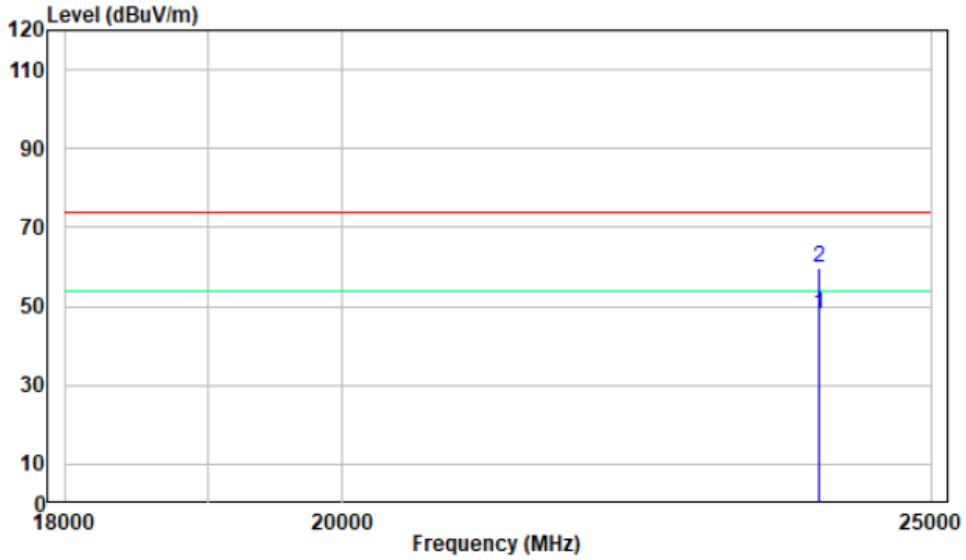


18 -25GHz:

Pre-scan for
Middle Channel
Horizontal



Vertical



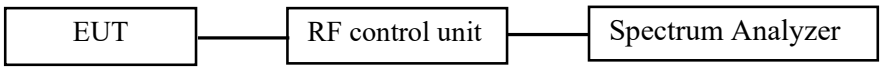
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH & OCCUPIED BANDWIDTH

Applicable Standard

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.



Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	57 %
ATM Pressure:	101.0 kPa

The testing was performed by Cat Kang on 2022-06-27.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the Appendix.

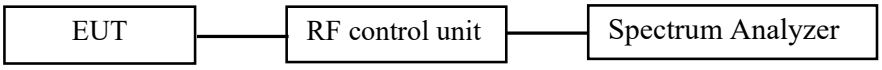
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

Applicable Standard

According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.



Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	57 %
ATM Pressure:	101.0 kPa

The testing was performed by Cat Kang on 2022-06-27.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the Appendix.

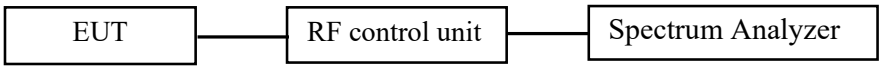
FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

Applicable Standard

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.



Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	57 %
ATM Pressure:	101.0 kPa

The testing was performed by Cat Kang on 2022-06-27.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the Appendix.

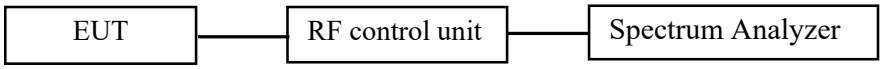
FCC §15.247(e) - POWER SPECTRAL DENSITY

Applicable Standard

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Test Procedure

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW to: 3kHz≤ RBW≤100 kHz.
3. Set the VBW ≥ 3×RBW.
4. Set the span to 1.5 times the DTS bandwidth.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.



Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	57 %
ATM Pressure:	101.0 kPa

The testing was performed by Cat Kang on 2022-06-27.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the Appendix.

APPENDIX

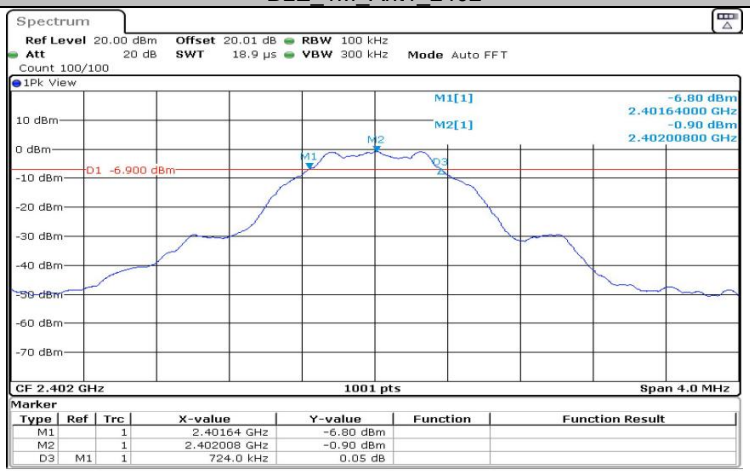
Appendix A: DTS Bandwidth

Test Result

Test Mode	Antenna	Channel	DTS BW [MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	0.72	0.5	PASS
		2440	0.72	0.5	PASS
		2480	0.72	0.5	PASS

Test Graphs

BLE_1M_Ant1_2402

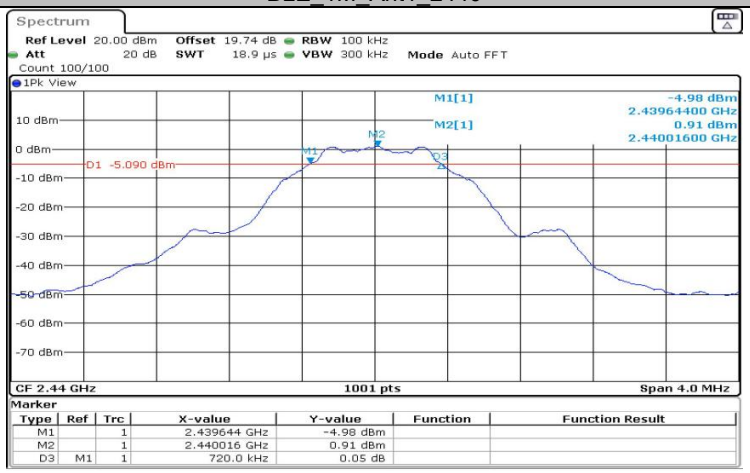


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40164 GHz	-6.80 dBm		
M2		1	2.402008 GHz	-0.90 dBm		
D3	M1	1	724.0 kHz	0.05 dB		

Date: 27.JUN.2022 20:51:07

BLE_1M_Ant1_2440

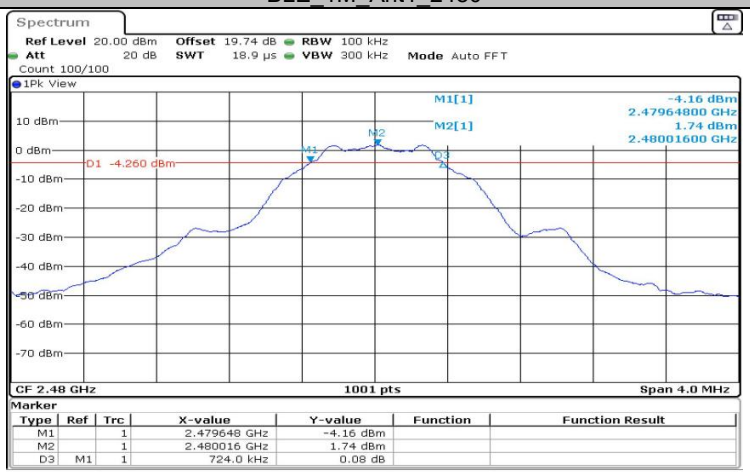


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.439644 GHz	-4.98 dBm		
M2		1	2.440016 GHz	0.91 dBm		
D3	M1	1	720.0 kHz	0.05 dB		

Date: 27.JUN.2022 20:52:59

BLE_1M_Ant1_2480



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.479648 GHz	-4.16 dBm		
M2		1	2.480016 GHz	1.74 dBm		
D3	M1	1	724.0 kHz	0.08 dB		

Date: 27.JUN.2022 20:54:14

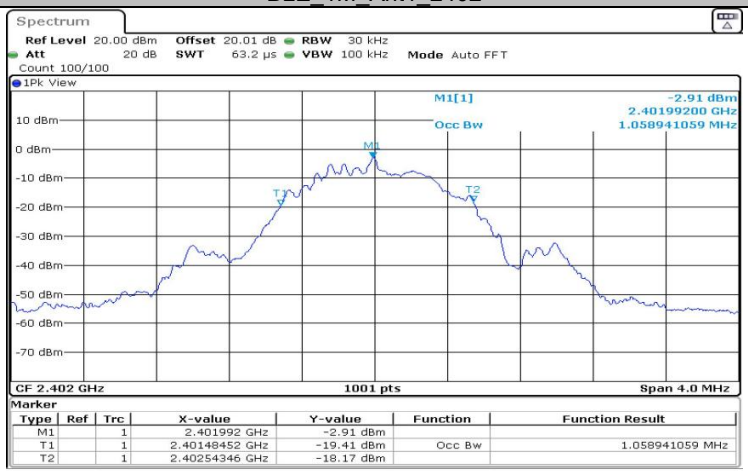
Appendix B: Occupied Channel Bandwidth

Test Result

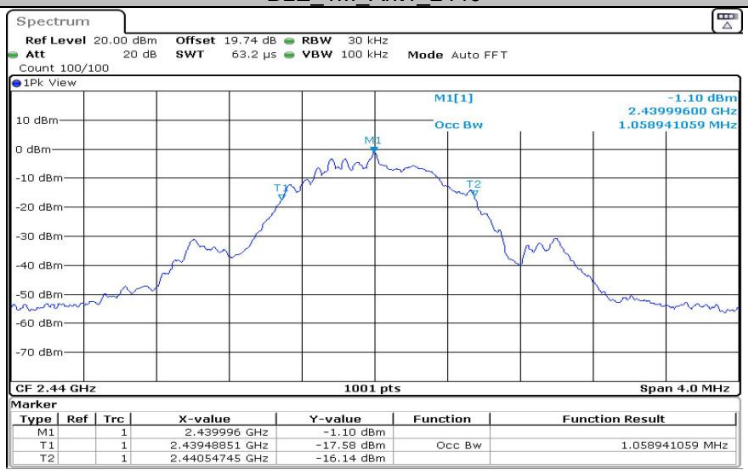
Test Mode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	1.059	2401.485	2402.543	---	---
		2440	1.059	2439.489	2440.547	---	---
		2480	1.059	2479.493	2480.551	---	---

Test Graphs

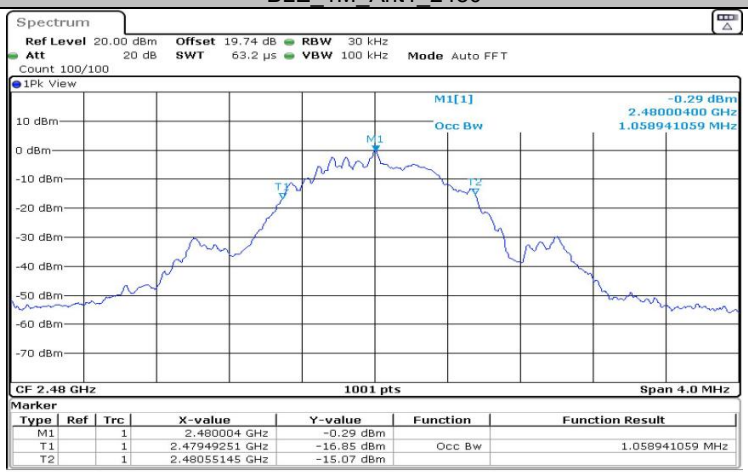
BLE_1M_Ant1_2402



BLE_1M_Ant1_2440



BLE_1M_Ant1_2480



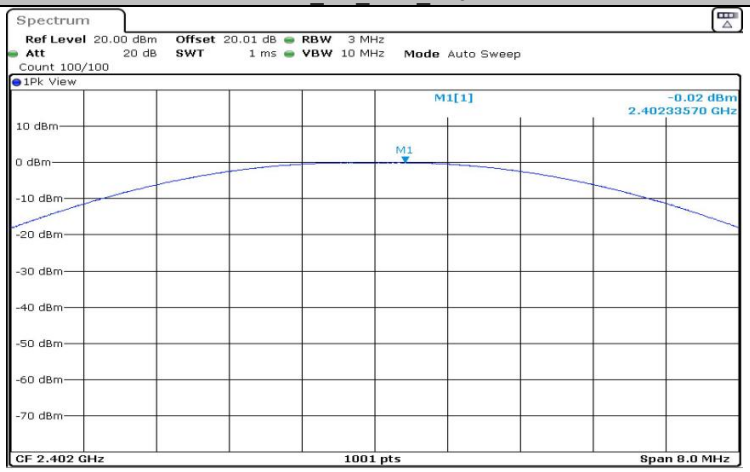
Appendix C: Maximum conducted Peak output power

Test Result

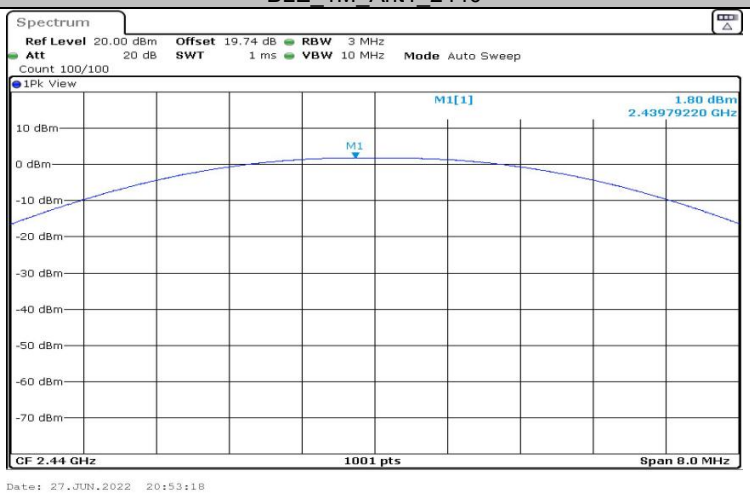
Test Mode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	-0.02	≤30	PASS
		2440	1.80	≤30	PASS
		2480	2.61	≤30	PASS

Test Graphs

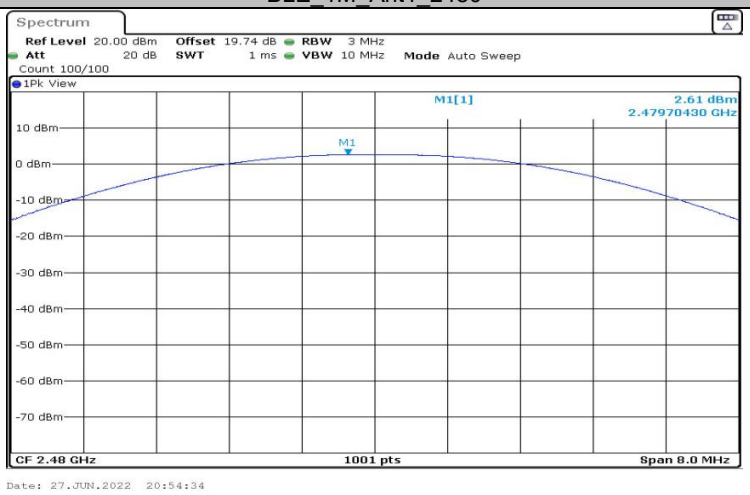
BLE_1M_Ant1_2402



BLE_1M_Ant1_2440



BLE_1M_Ant1_2480



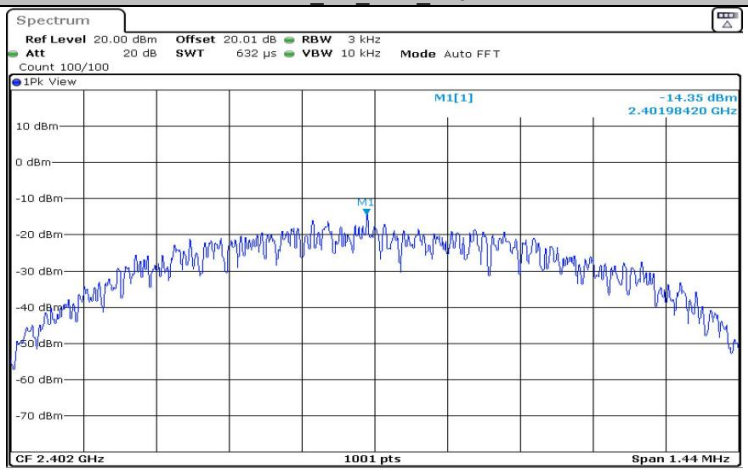
Appendix D: Maximum power spectral density

Test Result

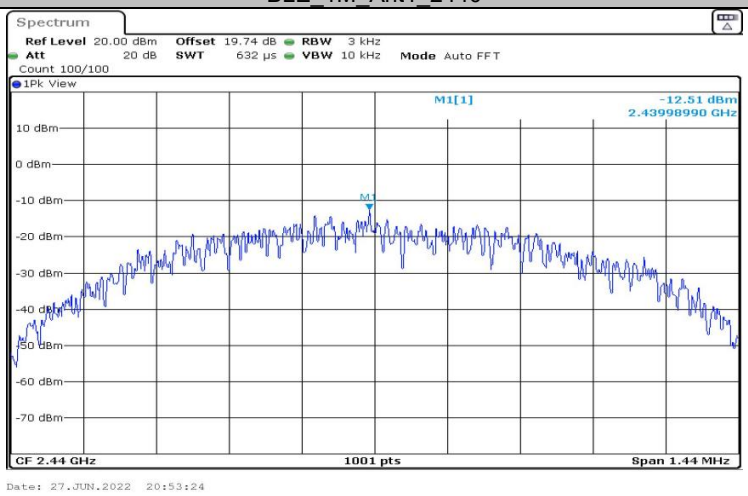
Test Mode	Antenna	Channel	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-14.35	≤8.00	PASS
		2440	-12.51	≤8.00	PASS
		2480	-11.61	≤8.00	PASS

Test Graphs

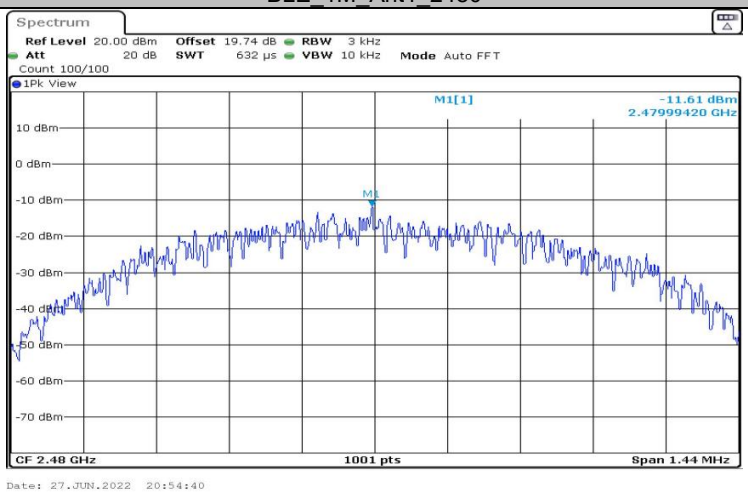
BLE_1M_Ant1_2402



BLE_1M_Ant1_2440



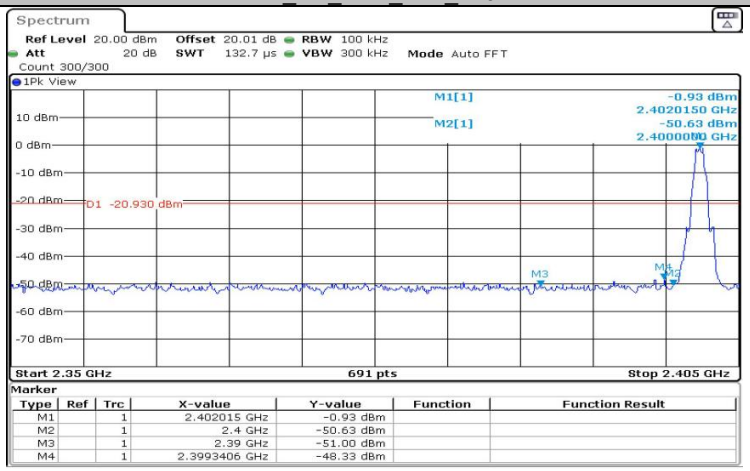
BLE_1M_Ant1_2480



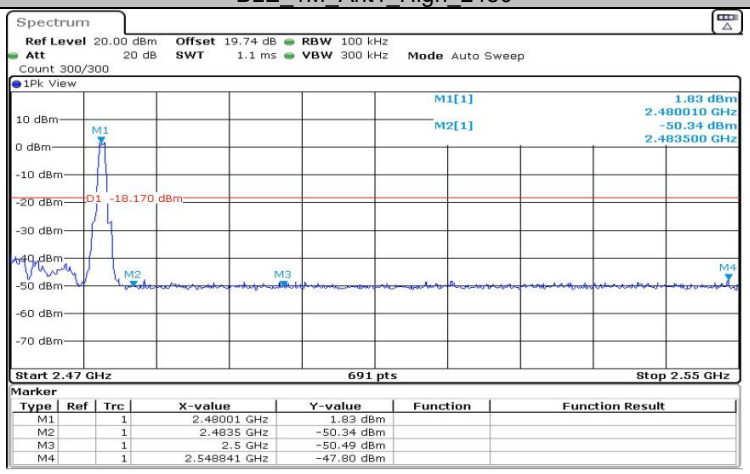
Appendix E:Band edge measurements

Test Graphs

BLE_1M_Ant1_Low_2402



BLE_1M_Ant1_High_2480



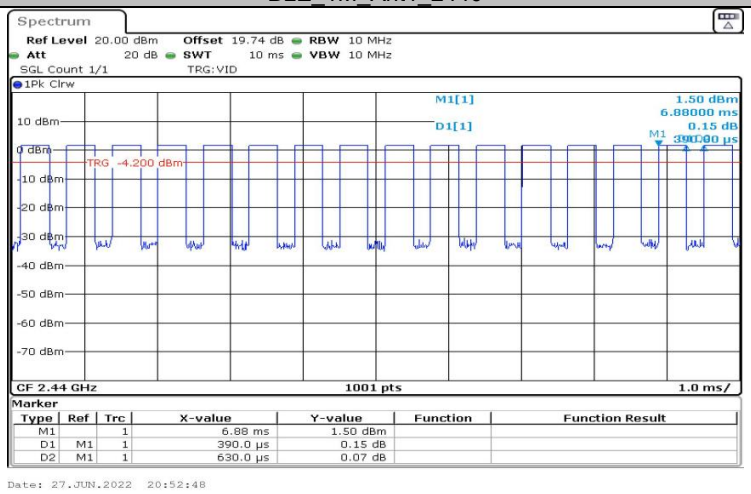
Appendix F: Duty Cycle

Test Result

TestMode	Antenna	Channel	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]
BLE_	Ant1	2440	0.39	0.63	61.90

Test Graphs

BLE_1M_Ant1_2440



******* END OF REPORT *******