FCC Part 15.249

TEST REPORT

For

ALATECH Technology Limited

39F., No. 758, Jungming S. RD. Taichung, Taiwan

FCC ID: YQOOB001

Report Type:	**Product Type:**
Original Report	Optical Heart Rate Armband

Report Producer : Kaylee Chiang

Report Number : RXZ181219003-00C

Report Date : 2019-02-14

Reviewed By: Jerry Chang

Prepared By: Bay Area Compliance Laboratories Corp.(Taiwan)
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Revision History

Revision	No.	Report Number	Issue Date	Description	Author/ Revised by
1.0	RXZ181219003	RXZ181219003-00C	2019-02-14	Original Report	Kaylee Chiang

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1 General Information

1.1 Product Description for Equipment under Test (EUT)

Applicant	ALATECH Technology Limited
	39F., No. 758, Jungming S. RD. Taichung, Taiwan
Manufacturer	ALATECH Technology Limited
	39F., No. 758, Jungming S. RD. Taichung, Taiwan
Brand(Trade) Name	ALATECH
Product (Equipment)	Optical Heart Rate Armband
Main Model Name	OB001
Frequency Range	2457 MHz
Antenna Specification	PCB Antenna / 3.027 dBi
Power Operation (Voltage Range)	☐ AC 120V/60Hz ☐ Adapter ☐ By AC Power Cord ☐ PoE
	☒ DC Type ☒ Battery: 3.7Vdc, 180mAh ☐ DC Power Supply ☒ External from USB Cable: 5Vdc ☐ External DC Adapter
	☐ Host System
Received Date	Dec 19, 2018
Date of Test	Jan 15, 2019 ~ Feb 13, 2019

**All measurement and test data in this report was gathered from production sample serial number: 181219003 (Assigned by BACL, Taiwan).*

1.2 Objective

This report is prepared on behalf of *ALATECH Technology Limited* 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 the ANT+ mode of EUT compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.209 and 15.249 rules.

1.3 Related Submittal(s)/Grant(s)

FCC Part 15.247 DTS submission with FCC ID: YQOOB001

1.4 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.

1.5 Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Taiwan) to collect test data is located on

☒70, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.

☐68-3, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.

Bay Area Compliance Laboratories Corp. (Taiwan) Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 3180) and the FCC designation No.TW3180 under the Mutual Recognition Agreement (MRA) in FCC Test. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.10.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 974454. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

2 System Test Configuration

2.1 Description of Test Configuration

The system was configured for testing in an engineering mode, which was provided by manufacturer. The engineering mode was configured the system transmitting with maximum power. For ANT+ mode, only 1 channel (2457MHz) was used.

2.2 Equipment Modifications

No modification was made to the EUT.

2.3 EUT Exercise Software

No test software was used.

2.4 Support Equipment List and Details

Description	Manufacturer	Model Number	BSMI	FCC ID	S/N
Adapter	SONY	AC-0401-TW	33084	N/A	211W45108973

2.5 External Cable List and Details

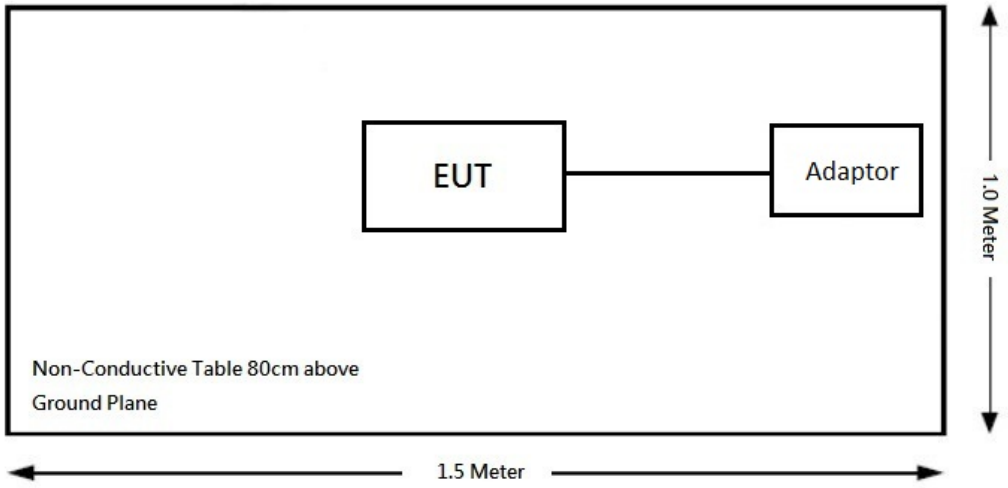
Cable Description	Length (m)	From	To
USB Cable (Includes charging base)	0.5	Adaptor	EUT

2.6 Block Diagram of Test Setup

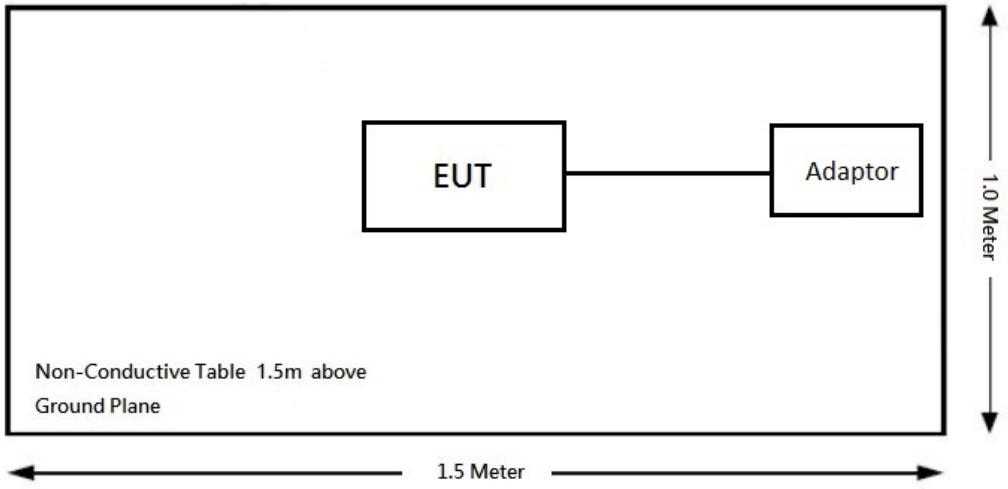
See test photographs attached in setup photos for the actual connections between EUT and support equipment.

Radiation:

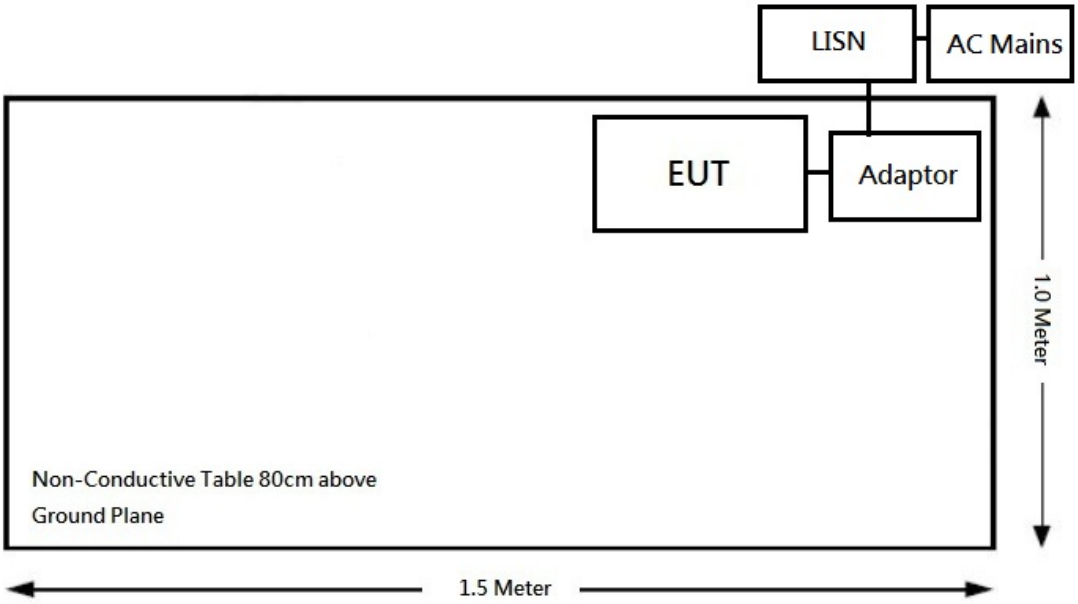
Below 1GHz:



Above 1GHz:



Conduction:


LISN
AC Mains
EUT
Adaptor
1.0 Meter
Non-Conductive Table 80cm above
Ground Plane
1.5 Meter

3 Summary of Test Results

FCC Rules	Description of Test	Results
§15.203	Antenna Requirement	Compliance
§15.207 (a)	AC Line Conducted Emissions	Compliance
§15.205, §15.209,§15.249	Radiated Emissions	Compliance
§15.215 (c)	20 dB Emission Bandwidth	Compliance

4 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
AC Line Conduction Room (CON-A)					
LISN	Rohde & Schwarz	ENV216	101612	2018/02/22	2019/02/21
EMI Test Receiver	Rohde & Schwarz	ESR7	101419	2018/10/23	2019/10/22
Pulse Limiter	Rohde & Schwarz	ESH3Z2	TXZEM104	2018/08/03	2019/08/02
RF Cable	EMEC	EM-CB5D	001	2018/07/02	2019/07/01
Software	AUDIX	E3	V9.150826k	N.C.R	N.C.R
Radiated Room (966-A)					
Bilog Antenna with 6 dB Attenuator	SUNOL SCIENCES & MINI-CIRCUITS	JB6/UNAT-6+	A050115/15542_01	2018/12/11	2019/12/10
Horn Antenna	EMCO	3115	9311-4158	2018/04/20	2019/04/19
Horn Antenna	ETS-Lindgren	3116	62638	2018/08/29	2019/08/28
Preamplifier	Sonoma	310N	130602	2018/07/04	2019/07/03
Preamplifier	EM Electronics Corp.	EM01G18G	060657	2018/12/07	2019/12/06
Microware Preamplifier	EM Electronics Corporation	EM18G40G	060656	2019/01/11	2020/01/10
EMI Test Receiver	Rohde & Schwarz	ESR7	101419	2018/10/23	2019/10/22
Spectrum Analyzer	Rohde & Schwarz	FSV40	101435	2018/02/12	2019/02/13
Micro flex Cable	UTIFLEX	FSCM 64639 / (2M)	93D0127	2018/07/31	2019/07/30
Micro flex Cable	UTIFLEX	UFA210A-1-3149-300300	MFR64639 226389-001	2018/11/16	2019/11/15
Micro flex Cable	ROSNOL	K1K50-UP0264-K1K50-450CM	160309-1	2018/03/05	2019/03/04
Micro flex Cable	ROSNOL	K1K50-UP0264-K1K50-80CM	160309-2	2019/01/16	2020/01/15
Turn Table	Champro	TT-2000	060772-T	N.C.R	N.C.R
Antenna Tower	Champro	AM-BS-4500-B	060772-A	N.C.R	N.C.R
Controller	Champro	EM1000	60772	N.C.R	N.C.R
Software	Farad	EZ_EMC	BACL-03A1	N.C.R	N.C.R

Description	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Room					
Spectrum Analyzer	Rohde & Schwarz	FSU26	200268	2018/05/04	2019/05/03
Cable	WOKEN	SFL402	S02-160323-07	2018/02/12	2019/02/11
Attenuator	MINI-CIRCUITS	BW-S10W5+	N/A	2018/03/08	2019/03/07

***Statement of Traceability:** BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to the SI System of Units via the R.O.C. Center for Measurement Standards of the Electronics Testing Center, Taiwan (ETC) or to another internationally recognized National Metrology Institute (NMI), and were compliant with the current Taiwan Accreditation Foundation (TAF) requirements*

5 FCC §15.203 – Antenna Requirements

5.1 Applicable Standard

For intentional device, 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.

5.2 Antenna Information

Manufacturer	Type	Antenna Gain	Result
ALATECH Technology Limited	PCB Antenna	3.027 dBi	Compliance

Result: Compliance.

6 FCC §15.207(a) – AC Line Conducted Emissions

6.1 Applicable Standard

According to §15.207

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56 Note 1	56 to 46 Note 2
0.5-5	56	46
5-30	60	50

Note 1: Decreases with the logarithm of the frequency.

Note 2: A linear average detector is required

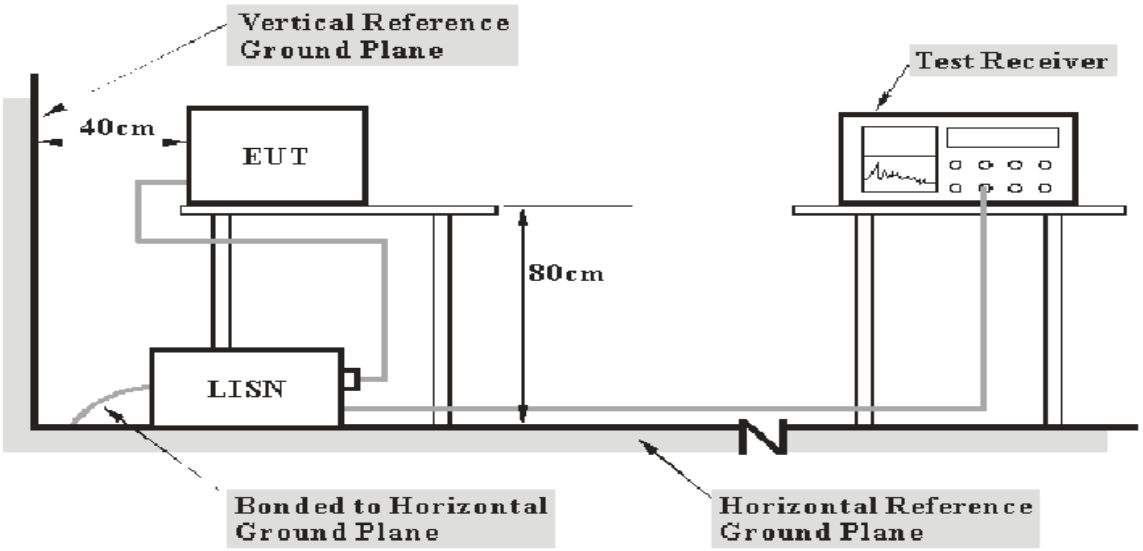
6.2 Measurement Uncertainty

Input quantities to be considered for conducted disturbance measurements maybe receiver reading, attenuation of the connection between LISN/ISN and receiver, LISN/ISN voltage division factor, LISN/ISN VDF frequency interpolation and receiver related input quantities, etc.

Based on CISPR 16-4-2:2011, the expended combined standard uncertainty of conducted disturbance test at Bay Area Compliance Laboratories Corp. (Taiwan) is shown as below. And the uncertainty will not be taken into consideration for the test data recorded in the report

Port	Expanded Measurement uncertainty
AC Mains	2.71 dB (k=2, 95% level of confidence)

6.3 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.

6.4 EMI Test Receiver Setup

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

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

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

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

6.6 Corrected Factor & Margin Calculation

The factor is calculated by adding LISN/ISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Factor = LISN VDF + Cable Loss + Transient Limiter Attenuation

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

Over Limit = Level – Limit Line

6.7 Environmental Conditions

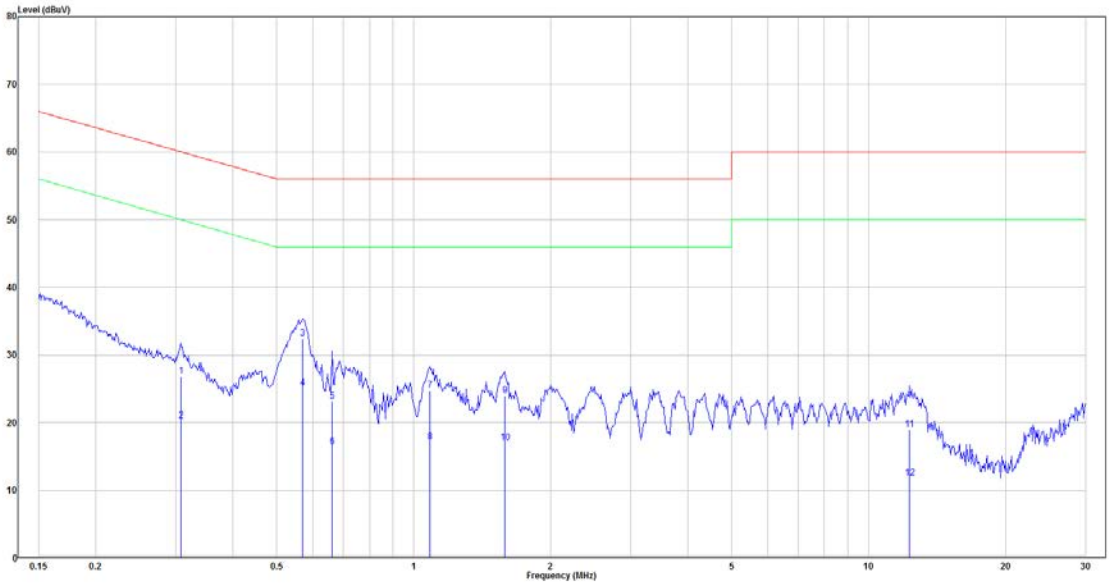
Temperature:	25 ℃
Relative Humidity:	55 %
ATM Pressure:	1010 hPa

The testing was performed by Tom Hsu on 2019-01-15.

6.8 Test Results

Test Mode: Transmitting

Main: AC120 V, 60 Hz, Line



No.	Frequency	Reading	Correct	Result	Limit	Over limit	Remark
	(MHz)	(dBµV)	Factor(dB)	(dBµV)	(dBµV)	(dB)	
1	0.307	7.35	19.47	26.81	60.04	-33.23	QP
2	0.307	0.75	19.47	20.22	50.04	-29.82	Average
3	0.570	12.93	19.48	32.41	56.00	-23.59	QP
4	0.570	5.68	19.48	25.16	46.00	-20.84	Average
5	0.662	3.64	19.48	23.12	56.00	-32.88	QP
6	0.662	-3.07	19.48	16.41	46.00	-29.59	Average
7	1.085	5.27	19.50	24.76	56.00	-31.24	QP
8	1.085	-2.42	19.50	17.08	46.00	-28.92	Average
9	1.585	4.41	19.53	23.94	56.00	-32.06	QP
10	1.585	-2.48	19.53	17.05	46.00	-28.95	Average
11	12.293	-0.69	19.73	19.04	60.00	-40.96	QP
12	12.293	-7.92	19.73	11.82	50.00	-38.18	Average

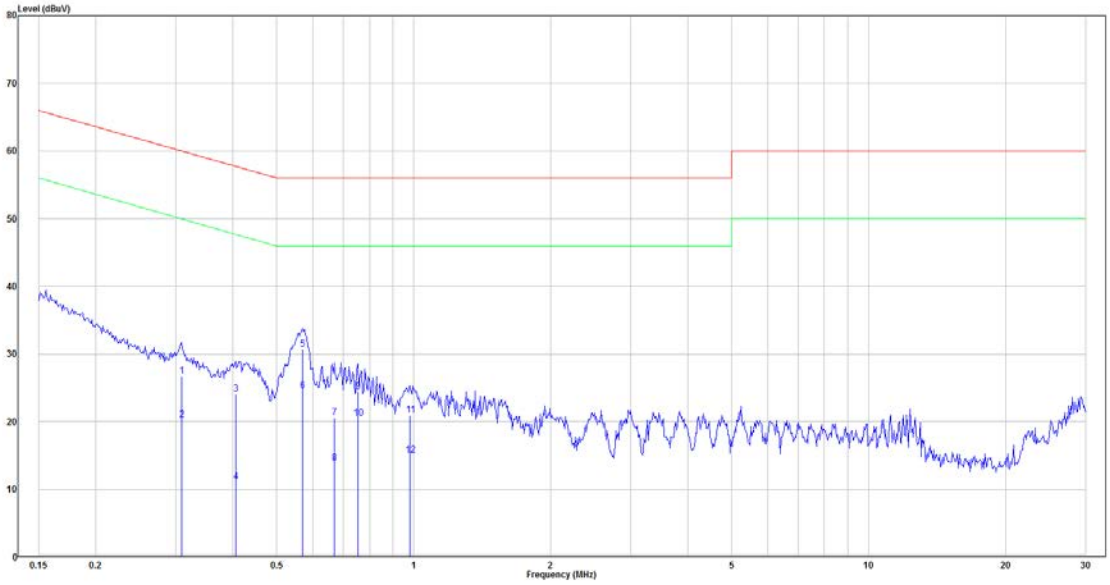
Note:

Level = Read Level + Factor

Over Limit = Level – Limit Line

Factor = (LISN, ISN, PLC or current probe) Factor + Cable Loss + Attenuator

Main: AC120 V, 60 Hz, Neutral



No.	Frequency	Reading	Correct	Result	Limit	Over limit	Remark
	(MHz)	(dBµV)	Factor(dB)	(dBµV)	(dBµV)	(dB)	
1	0.309	7.26	19.46	26.72	60.00	-33.27	QP
2	0.309	0.77	19.46	20.23	50.00	-29.77	Average
3	0.406	4.67	19.46	24.14	57.72	-33.59	QP
4	0.406	-8.38	19.46	11.08	47.72	-36.64	Average
5	0.570	11.26	19.47	30.73	56.00	-25.27	QP
6	0.570	5.10	19.47	24.57	46.00	-21.43	Average
7	0.669	1.16	19.47	20.63	56.00	-35.37	QP
8	0.669	-5.57	19.47	13.90	46.00	-32.10	Average
9	0.754	4.93	19.48	24.41	56.00	-31.59	QP
10	0.754	0.96	19.48	20.44	46.00	-25.56	Average
11	0.982	1.50	19.48	20.98	56.00	-35.02	QP
12	0.982	-4.38	19.48	15.10	46.00	-30.90	Average

Note:

Level = Read Level + Factor

Over Limit = Level – Limit Line

Factor = (LISN, ISN, PLC or current probe) Factor + Cable Loss + Attenuator

7 FCC §15.209, §15.205 , §15.249 - Radiated Emissions

7.1 Applicable Standard

As per FCC§15.249 (a), except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (millivolts/meter)
920-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

As per FCC§15.249 (c), Field strength limits are specified at a distance of 3 meters.

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

7.2 Measurement Uncertainty

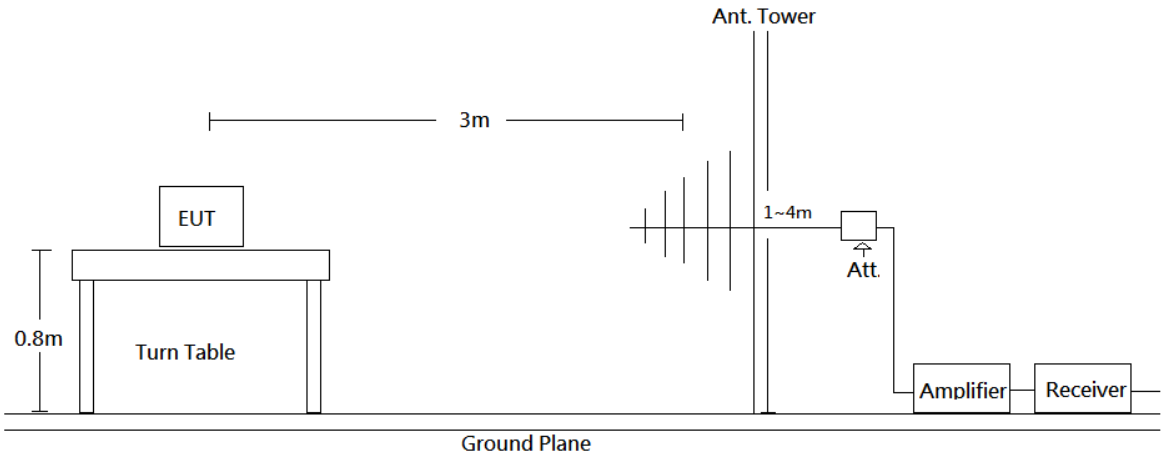
All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on CISPR 16-4-2:2011, the expended combined standard uncertainty of radiation emissions at Bay Area Compliance Laboratories Corp. (Taiwan) is shown in below table. And the uncertainty will not be taken into consideration for the test data recorded in the report.

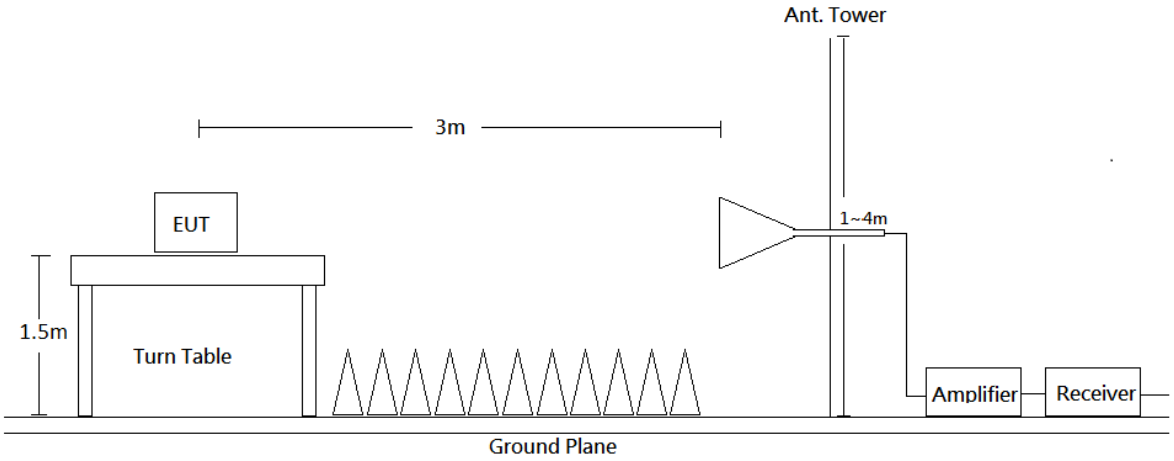
Frequency	Measurement uncertainty
30 MHz~200 MHz	3.75 dB (k=2, 95% level of confidence)
200 MHz~1 GHz	4.21 dB (k=2, 95% level of confidence)
1 GHz~6 GHz	4.83 dB (k=2, 95% level of confidence)
6 GHz~18 GHz	5.18 dB (k=2, 95% level of confidence)
18 GHz~26 GHz	4.55 dB (k=2, 95% level of confidence)
26 GHz~40 GHz	4.67 dB (k=2, 95% level of confidence)

7.3 EUT Setup

Below 1 GHz:



Above 1 GHz:



Radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.249 limits.

7.4 EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 26.5 GHz. During the radiated emission test, the EMI test receiver was set with the following configurations measurement method 6.3 in ANSI C63.10.

Frequency Range	RBW	VBW	Measurement method
30-1000 MHz	120 kHz	/	QP
Above 1 GHz	1 MHz	3 MHz	PK
	1 MHz	10 Hz	Ave

7.5 Test Procedure

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

All data was recorded in the Quasi-peak detector mode from 30 MHz to 1 GHz and PK and average detector modes for frequencies above 1 GHz.

7.6 Corrected Factor & Margin Calculation

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

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

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

Margin = Result – Limit

7.7 Test Results Summary

According to the data in the following table, the EUT complied with the FCC §15.209 Limit.

7.8 Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	55 %
ATM Pressure:	1010 hPa

The testing was performed by Tom Hsu on 2019-02-11 ~ 2019-02-12.

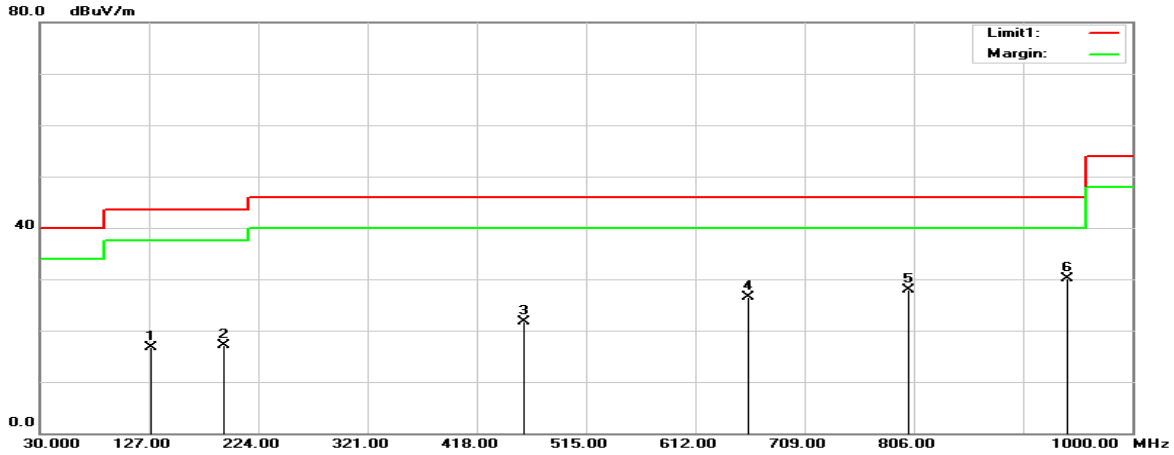
7.9 Test Results

Test Mode: Transmitting

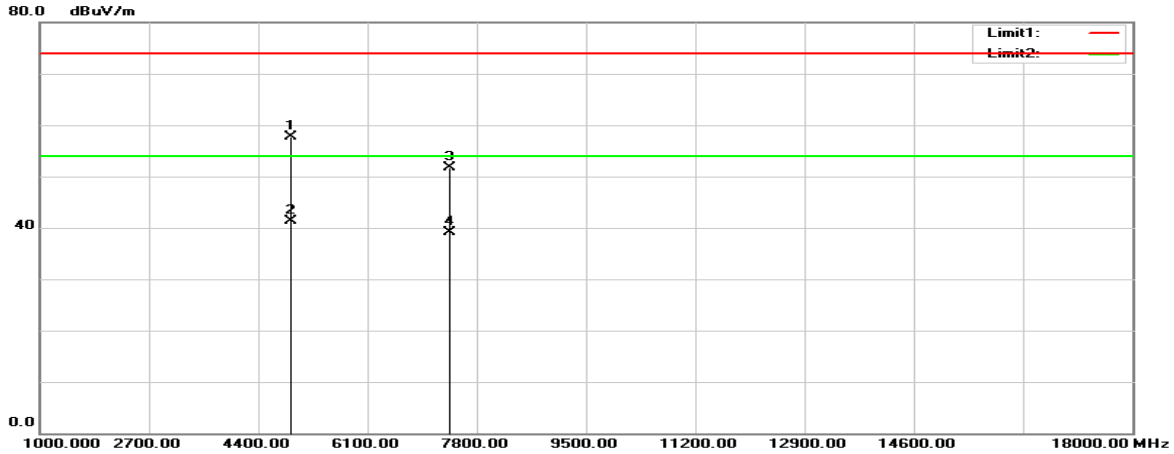
ANT+ Mode *(Pre-scan with three orthogonal axis, and worse case as Z axis.)*

Horizontal

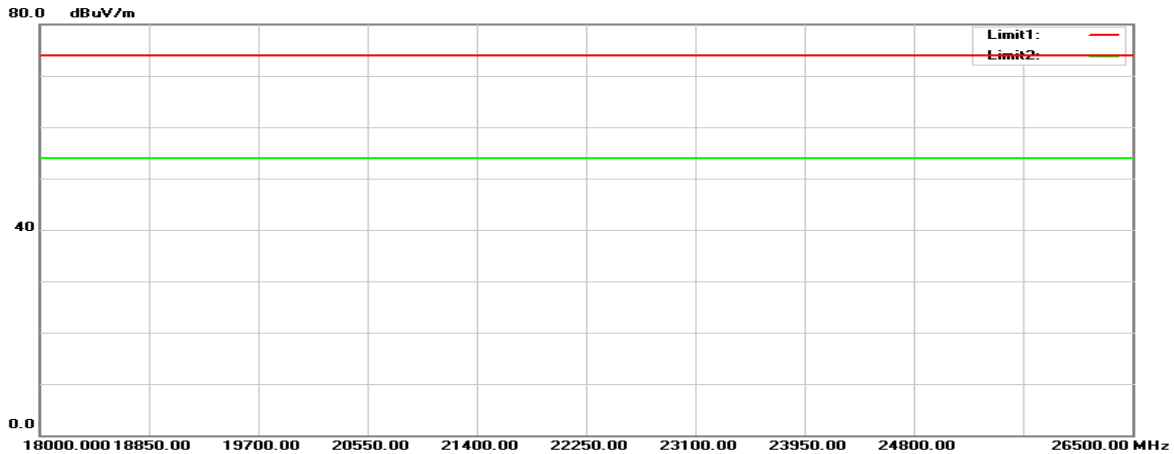
30MHz-1GHz:



1GHz-18GHz:

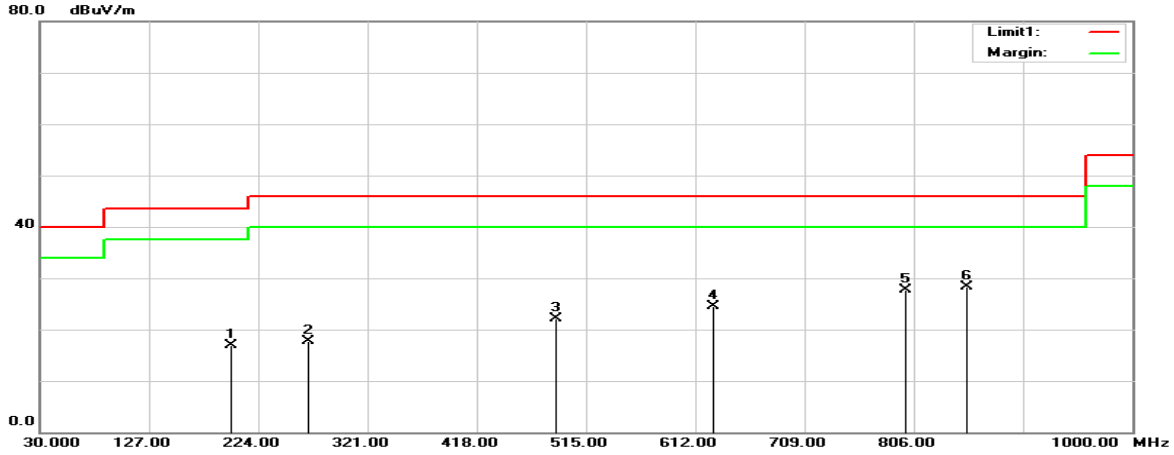


18GHz-26.5GHz:

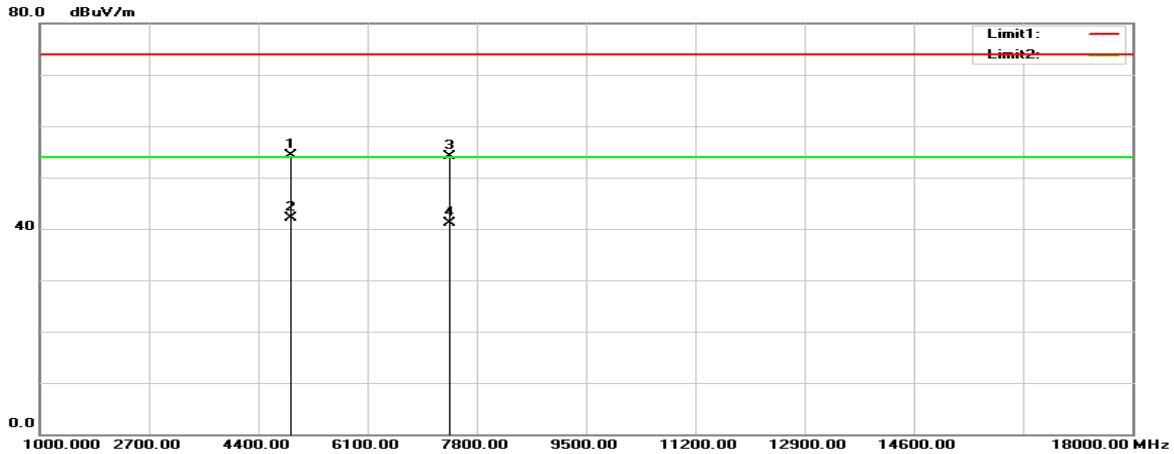


Vertical

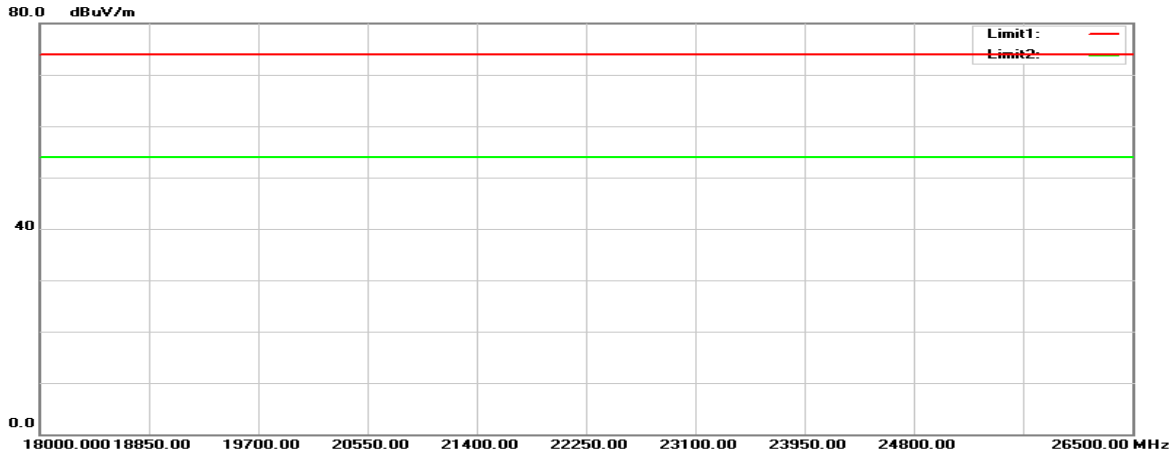
30MHz-1GHz:



1GHz-18GHz:



18GHz-26.5GHz:



Horizontal

Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
128.9400	27.15	-10.54	16.61	43.50	-26.89	100	0	QP
193.9300	29.05	-11.95	17.10	43.50	-26.40	100	15	QP
459.7100	28.12	-6.37	21.75	46.00	-24.25	100	172	QP
659.5300	29.67	-3.25	26.42	46.00	-19.58	100	84	QP
801.1500	28.51	-0.55	27.96	46.00	-18.04	100	254	QP
941.8000	27.62	2.45	30.07	46.00	-15.93	100	336	QP
2390.000	57.74	-4.89	52.85	74.00	-21.15	150	266	peak
2390.000	45.36	-4.89	40.47	54.00	-13.53	150	266	AVG
2400.000	57.99	-4.86	53.13	74.00	-20.87	150	321	peak
2400.000	45.95	-4.86	41.09	54.00	-12.91	150	321	AVG
*2457.000	89.88	-4.74	85.14	114.00	-28.86	150	133	peak
*2457.000	72.15	-4.74	67.41	94.00	-26.59	150	133	AVG
2483.500	57.67	-4.69	52.98	74.00	-21.02	150	118	peak
2483.500	45.47	-4.69	40.78	54.00	-13.22	150	118	AVG
4914.000	56.37	1.35	57.72	74.00	-16.28	100	163	peak
4914.000	39.89	1.35	41.24	54.00	-12.76	100	163	AVG
7371.000	44.55	7.21	51.76	74.00	-22.24	100	241	peak
7371.000	31.82	7.21	39.03	54.00	-14.97	100	241	AVG

Vertical

Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
199.7500	27.72	-10.76	16.96	43.50	-26.54	100	265	QP
268.6200	28.24	-10.46	17.78	46.00	-28.22	100	24	QP
488.8100	27.95	-5.90	22.05	46.00	-23.95	100	335	QP
628.4900	28.20	-3.62	24.58	46.00	-21.42	100	285	QP
799.2100	28.31	-0.58	27.73	46.00	-18.27	100	76	QP
852.5600	27.90	0.47	28.37	46.00	-17.63	100	68	QP
2390.000	57.90	-4.89	53.01	74.00	-20.99	100	177	peak
2390.000	46.57	-4.89	41.68	54.00	-12.32	100	177	AVG
2400.000	57.45	-4.86	52.59	74.00	-21.41	100	251	peak
2400.000	46.32	-4.86	41.46	54.00	-12.54	100	251	AVG
*2457.000	98.82	-4.74	94.08	114.00	-19.92	100	228	peak
*2457.000	77.93	-4.74	73.19	94.00	-20.81	100	228	AVG
2483.500	56.91	-4.69	52.22	74.00	-21.78	100	110	peak
2483.500	45.01	-4.69	40.32	54.00	-13.68	100	110	AVG
4914.000	53.02	1.35	54.37	74.00	-19.63	100	39	peak
4914.000	40.78	1.35	42.13	54.00	-11.87	100	39	AVG
7371.000	46.82	7.21	54.03	74.00	-19.97	100	210	peak
7371.000	33.92	7.21	41.13	54.00	-12.87	100	210	AVG

Result = Reading + Correct Factor
Margin = Result – Limit
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain
Spurious emissions more than 20 dB below the limit were not reported.

8 FCC §15.215(c) – 20 dB Bandwidth Testing

8.1 Applicable Standard

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

8.2 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 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

8.3 Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	55 %
ATM Pressure:	1010 hPa

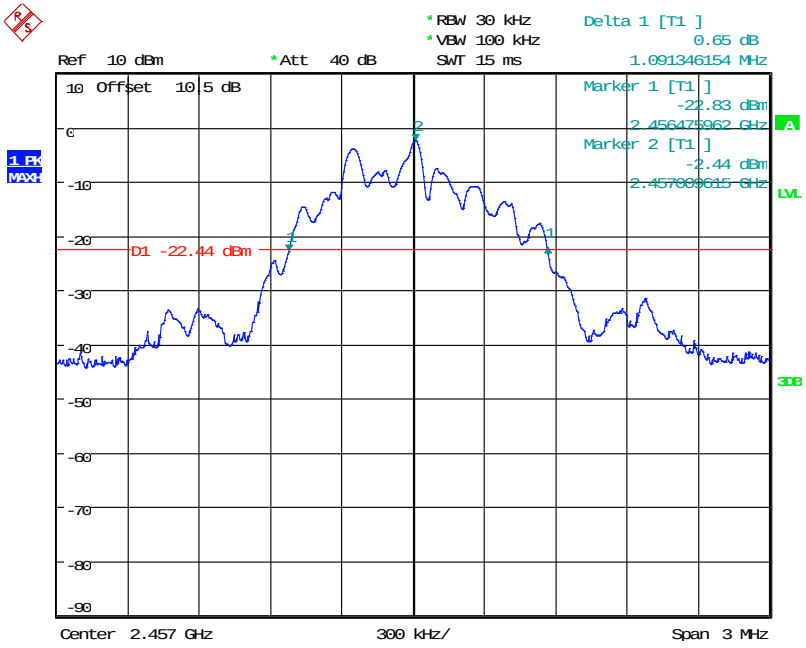
The testing was performed by Tom Hsu on 2019-02-01.

8.4 Test Results

Frequency (MHz)	20 dB Emission Bandwidth (MHz)
2457	1.09

Please refer to the following plots

ANT+ Mode



Date: 1.FEB.2019 10:30:33

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