



# TEST REPORT

Report Reference No.....	<b>CHTEW1911006204</b>	Report verification:
Project No.....	<b>SHT1908062702EW</b>	 ReportNo:CHTEW19110062
FCC ID .....	<b>2AIGUDOKIPAL</b>	
Applicant's name .....	<b>DOKI TECHNOLOGIES LIMITED</b>	
Address.....	Unit 601,6/F,Tower One,Silvercord, 30 Canton Road,TST, Kowloon	
Manufacturer.....	DOKI TECHNOLOGIES LIMITED	
Address.....	Unit 601,6/F,Tower One,Silvercord, 30 Canton Road,TST, Kowloon	
Test item description .....	<b>dokiPal</b>	
Trade Mark .....	doki	
Model/Type reference.....	dokiPal	
Listed Model(s) .....	dokiPal-1001	
Standard .....	<b>FCC CFR Title 47 Part 15 Subpart C Section 15.247</b>	
Date of receipt of test sample.....	May 06, 2019	
Date of testing.....	May 07, 2019- Nov 05, 2019	
Date of issue.....	Nov 06, 2019	
Result.....	<b>PASS</b>	

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Approved by ( Position+Printed name+Signature) :	RF Manager Hans Hu	

Testing Laboratory Name .....	<b>Shenzhen Huatongwei International Inspection Co., Ltd.</b>
Address.....	1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

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The test report merely correspond to the test sample.

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## **1. TEST STANDARDS AND REPORT VERSION**

### **1.1. Test Standards**

The tests were performed according to following standards:

[FCC Rules Part 15.247](#): Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

[ANSI C63.10:2013](#): American National Standard for Testing Unlicensed Wireless Devices

[KDB 558074 D01 15.247 Meas Guidance v05r01](#): Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating under Section 15.247 of The FCC Rules

### **1.2. Report version**

Revision No.	Date of issue	Description
N/A	2019-11-06	Add some components to charging circuit,make difference test on Radiated Spurious Emission,others are the same as report No. CHTEW19060019

## 2. TEST DESCRIPTION

Test Item	FCC Rule	Result	Test Engineer
Antenna requirement	15.203/15.247(c)	PASS	Jiongsheng Feng
Line Conducted Emissions (AC Main)	15.207	PASS	Jiongsheng Feng
Conducted Peak Output Power	15.247(b)(3)	PASS	Jiongsheng Feng
Power Spectral Density	15.247(e)	PASS	Jiongsheng Feng
6dB Bandwidth	15.247(a)(2)	PASS	Jiongsheng Feng
Restricted band	15.247(d)/15.205	PASS	Pan Xie
Spurious Emissions	15.247(d)/15.209	PASS	Pan Xie

Note: The measurement uncertainty is not included in the test result.

### 3. SUMMARY

#### 3.1. Client Information

Applicant:	DOKI TECHNOLOGIES LIMITED
Address:	Unit 601,6/F,Tower One,Silvercord, 30 Canton Road,TST,Kowloon
Manufacturer:	DOKI TECHNOLOGIES LIMITED
Address:	Unit 601,6/F,Tower One,Silvercord, 30 Canton Road,TST,Kowloon

#### 3.2. Product Description

Name of EUT:	dokiPal
Trade Mark:	doki
Model No.:	dokiPal
Listed Model(s):	dokiPal-1001
Power supply:	DC 3.85V
Hardware version:	BRT Version V0
Software version:	0.1.5-alpha
<b>Bluetooth</b>	
Version:	Supported BT4.1+BLE
Modulation:	GFSK
Operation frequency:	2402MHz~2480MHz
Channel number:	40
Channel separation:	2MHz
Antenna type:	Internal Antenna
Antenna gain:	-5.0dBi

### 3.3. Operation state

#### ➤ Test frequency list

According to section 15.31(m), regards to the operating frequency range over 10 MHz, must select three channel which were tested. the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, please see the above gray bottom.

Channel	Frequency (MHz)
00	2402
01	2404
:	:
19	2440
:	:
38	2478
39	2480

#### ➤ Test mode

##### For RF test items

The engineering test program was provided and enabled to make EUT continuous transmit (duty cycle>98%).

##### For AC power line conducted emissions:

The EUT was set to connect with the Bluetooth instrument under large package sizes transmission.

##### For Radiated suprious emissions test item:

The engineering test program was provided and enabled to make EUT continuous transmit(duty cycle>98%). The EUT in each of three orthogonal axis emissions had been tested ,but only the worst case (X axis) data Recorded in the report.

### 3.4. EUT configuration

**The following peripheral devices and interface cables were connected during the measurement:**

- - supplied by the manufacturer
- - supplied by the lab

/	Manufacturer:	/
	Model No.:	/
/	Manufacturer:	/
	Model No.:	/

### 3.5. Modifications

No modifications were implemented to meet testing criteria.

## **4. TEST ENVIRONMENT**

### **4.1. Address of the test laboratory**

Laboratory: Shenzhen Huatongwei International Inspection Co., Ltd.

Address: 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

### **4.2. Test Facility**

#### **CNAS-Lab Code: L1225**

Shenzhen Huatongwei International Inspection Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

#### **A2LA-Lab Cert. No.: 3902.01**

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

#### **FCC-Registration No.: 762235**

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files.

#### **IC-Registration No.:5377A**

Two 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No.: 5377A.

#### **ACA**

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our A2LA accreditation.

### 4.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15~35°C
Relative Humidity:	30~60 %
Air Pressure:	950~1050mba

### 4.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors in calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report according to TR-100028-01 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2" and is documented in the Shenzhen Huatongwei International Inspection Co., Ltd. quality system according to ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Here after the best measurement capability for Shenzhen Huatongwei International Inspection Co., Ltd. is reported:

Test Items	Measurement Uncertainty	Notes
Transmitter power conducted	0.63 dB	(1)
Conducted spurious emissions 9kHz~40GHz	0.63 dB	(1)
Conducted Disturbance 150kHz~30MHz	3.35 dB	(1)
Radiated Emissions below 1GHz	4.28 dB	(1)
Radiated Emissions above 1GHz	5.16 dB	(1)
Occupied Bandwidth	69 Hz	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=1.96$ .

#### 4.5. Equipments Used during the Test

● Conducted Emission						
Used	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Shielded Room	Albatross projects	N/A	N/A	2018/09/28	2023/09/27
●	EMI Test Receiver	R&S	ESCI	101247	2018/10/27	2019/10/26
●	Artificial Mains	SCHWARZBECK	NNLK 8121	573	2018/10/27	2019/10/26
●	Pulse Limiter	R&S	ESH3-Z2	100499	2018/10/27	2019/10/26
●	RF Connection Cable	HUBER+SUHNER	EF400	N/A	2018/11/15	2019/11/14
●	Test Software	R&S	ES-K1	N/A	N/A	N/A
○	Single Balanced Telecom Pair ISN	FCC	FCC-TLISN-T2-02	20371	2018/10/28	2019/10/27
○	Two Balanced Telecom Pairs ISN	FCC	FCC-TLISN-T4-02	20373	2018/10/28	2019/10/27
○	Four Balanced Telecom Pairs ISN	FCC	FCC-TLISN-T8-02	20375	2018/10/28	2019/10/27
○	V-Network	R&S	ESH3-Z6	100211	2018/10/27	2019/10/26
○	V-Network	R&S	ESH3-Z6	100210	2018/10/27	2019/10/26
○	2-Line V-Network	R&S	ESH3-Z5	100049	2018/10/27	2019/10/26

● Radiated Emission-6th test site						
Used	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Semi-Anechoic Chamber	Albatross projects	SAC-3m-02	N/A	2018/09/30	2021/09/29
●	EMI Test Receiver	R&S	ESCI	100900	2019/10/26	2020/10/25
○	Loop Antenna	R&S	HFH2-Z2	100020	2017/11/20	2020/11/19
●	Ultra-Broadband Antenna	SCHWARZBECK	VULB9163	546	2017/04/05	2020/04/04
●	Pre-Amplifier	SCHWARZBECK	BBV 9742	N/A	2018/11/15	2019/11/14
●	RF Connection Cable	HUBER+SUHNER	N/A	N/A	2019/8/21	2020/8/20
●	RF Connection Cable	HUBER+SUHNER	SUCOFLEX104	501184/4	2019/8/21	2020/8/20
●	Test Software	R&S	ES-K1	N/A	N/A	N/A
●	Turntable	Maturo Germany	TT2.0-1T	N/A	N/A	N/A
●	Antenna Mast	Maturo Germany	CAM-4.0-P-12	N/A	N/A	N/A

● Radiated emission-7th test site						
Used	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Semi-Anechoic Chamber	Albatross projects	SAC-3m-01	N/A	2018/09/30	2021/09/29
●	Spectrum Analyzer	R&S	FSP40	100597	2019/10/26	2020/10/25
●	Horn Antenna	SCHWARZBECK	9120D	1011	2017/03/27	2020/03/26
○	Pre-amplifier	BONN	BLWA0160-2M	1811887	2018/11/14	2019/11/13
●	Pre-amplifier	CD	PAP-0102	12004	2018/11/14	2019/11/13
●	Broadband Pre-amplifier	SCHWARZBECK	BBV 9718	9718-248	2019/04/26	2020/04/25
●	RF Connection Cable	HUBER+SUHNER	RE-7-FH	N/A	2018/11/15	2019/11/14
●	RF Connection Cable	HUBER+SUHNER	RE-7-FL	N/A	2018/11/15	2019/11/14
●	Test Software	Audix	E3	N/A	N/A	N/A

●	Turntable	Maturo Germany	TT2.0-1T	N/A	N/A	N/A
●	Antenna Mast	Maturo Germany	CAM-4.0-P-12	N/A	N/A	N/A

● RF Conducted Method						
Used	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Signal and spectrum Analyzer	R&S	FSV40	100048	2018/10/28	2019/10/27
●	Spectrum Analyzer	Agilent	N9020A	MY50510187	2018/09/29	2019/09/28
○	Radio communication tester	R&S	CMW500	137688-Lv	2018/09/29	2019/09/28
○	Test software	Tonscend	JS1120-1(LTE)	N/A	N/A	N/A
○	Test software	Tonscend	JS1120-2(WIFI)	N/A	N/A	N/A
○	Test software	Tonscend	JS1120-3(WCDMA)	N/A	N/A	N/A
○	Test software	Tonscend	JS1120-4(GSM)	N/A	N/A	N/A

## 5. **TEST CONDITIONS AND RESULTS**

### 5.1. Antenna Requirement

#### Requirement

##### **FCC CFR Title 47 Part 15 Subpart C Section 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, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

##### **FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1)(i):**

(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

#### **TEST RESULTS**

Passed       Not Applicable

The directional gain of the antenna less than 6 dBi, please refer to the below antenna photo.



## 5.2. Conducted Emissions (AC Main)

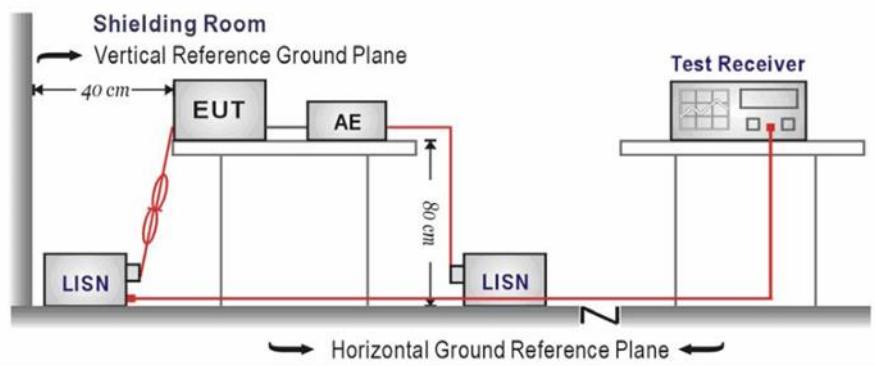
### LIMIT

#### FCC CFR Title 47 Part 15 Subpart C Section 15.207

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

\* Decreases with the logarithm of the frequency.

### TEST CONFIGURATION



### TEST PROCEDURE

1. The EUT was setup according to ANSI C63.10:2013 requirements.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface.
3. The EUT and simulators are connected to the main power through a line impedances stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment.
4. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs)
5. Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.
6. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
7. Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
8. During the above scans, the emissions were maximized by cable manipulation.

### TEST MODE:

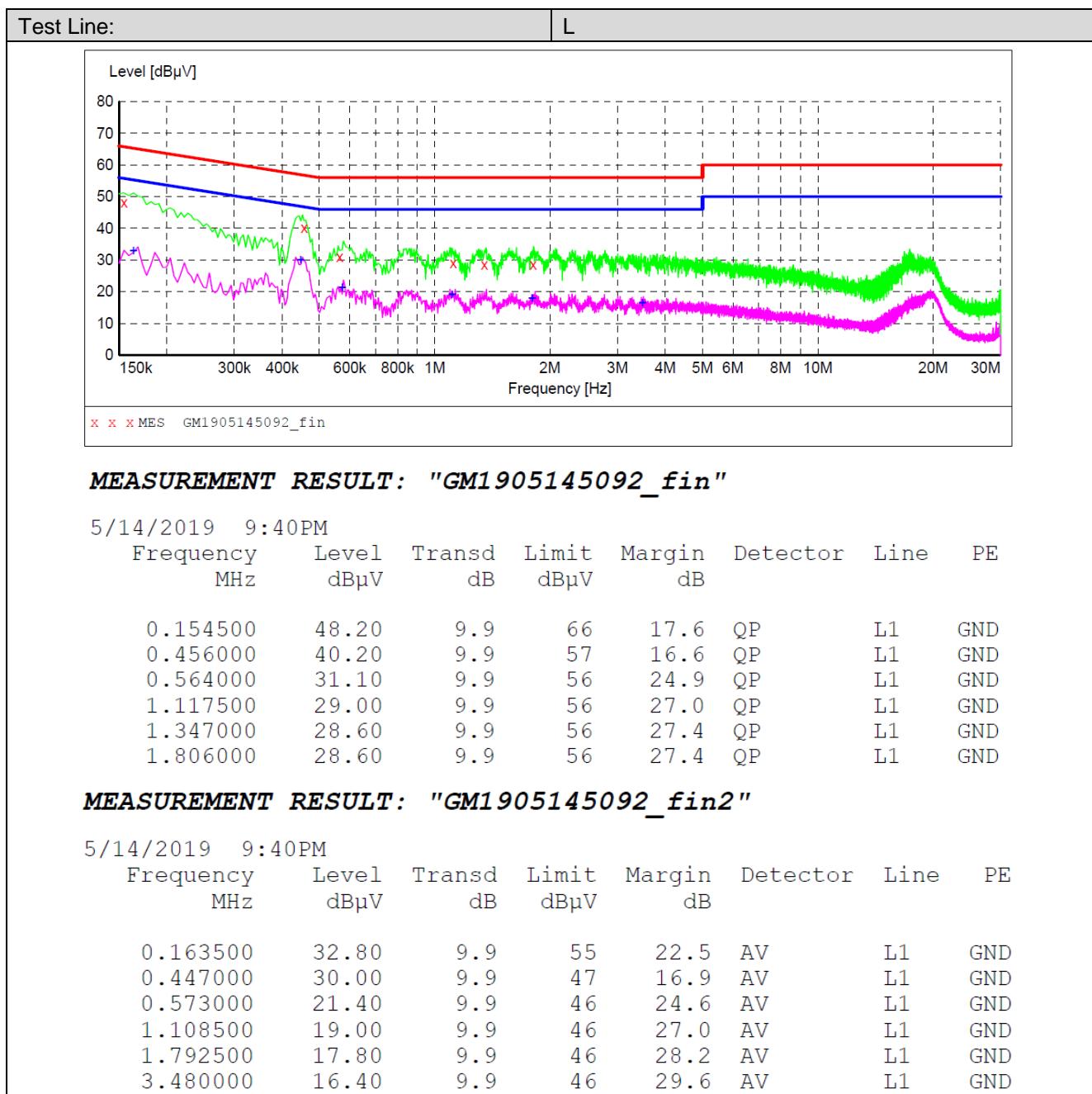
Please refer to the clause 3.3

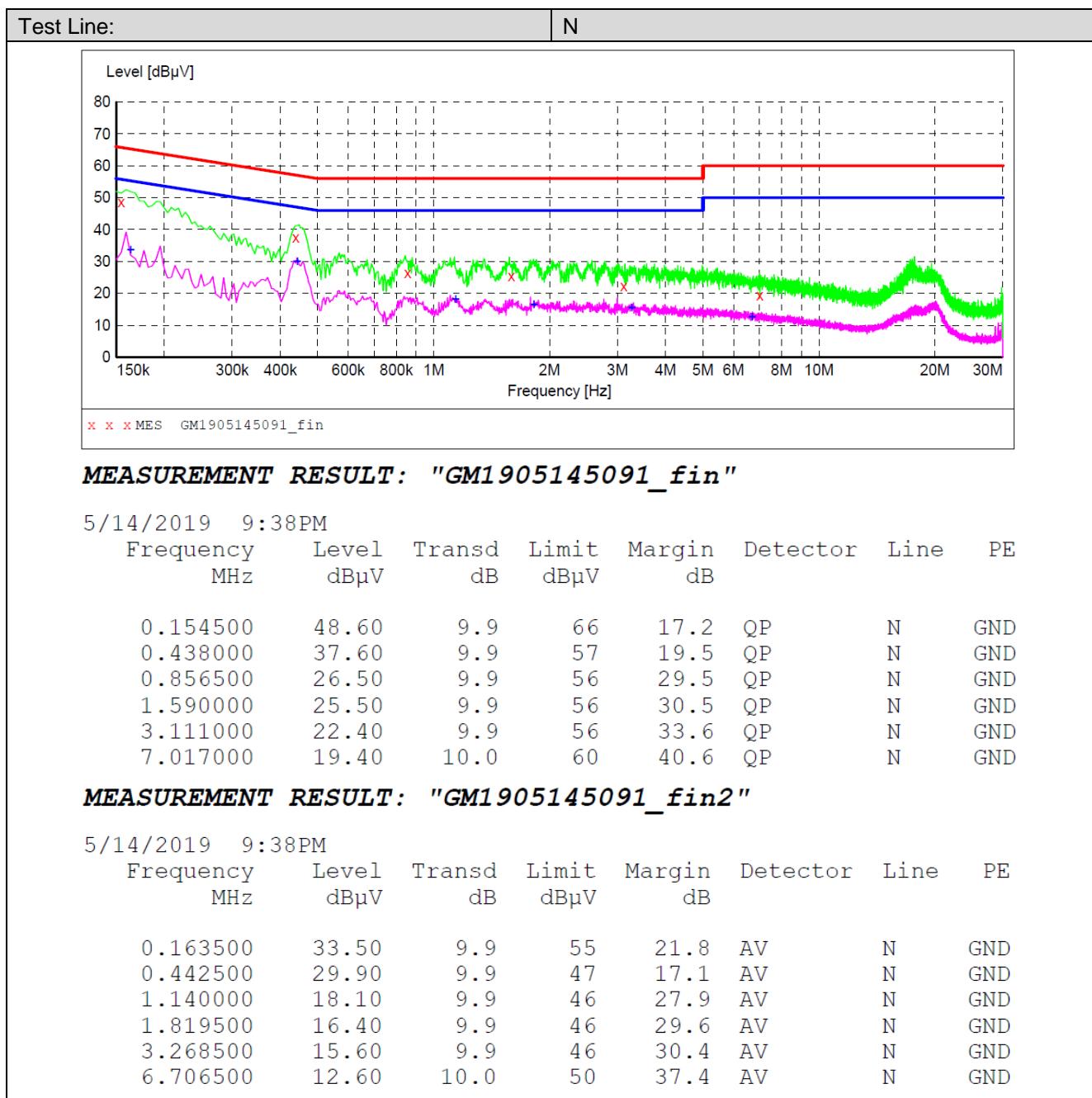
### TEST RESULTS

Passed       Not Applicable

#### Note:

- 1) Transd = Cable loss + Pulse Limiter Factor + Artificial Mains Factor
- 2) Margin = Limit - Level



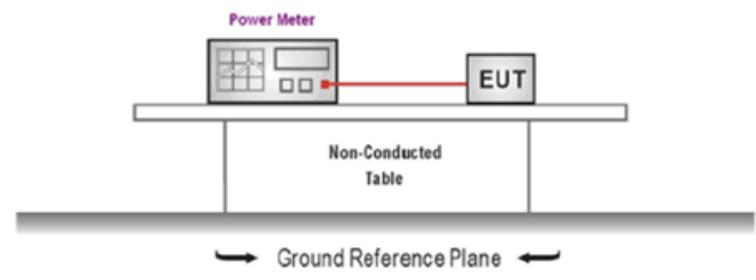


### 5.3. Conducted Peak Output Power

#### LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (b)(3): 30 dBm

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. The EUT was tested according to ANSI C63.10: 2013 and KDB 558074 D01 for compliance to FCC 47 CFR 15.247 requirements.
2. The maximum peak conducted output power may be measured using a broadband peak RF power meter.
3. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.
4. Record the measurement data.

#### TEST MODE:

Please refer to the clause 3.3

#### TEST RESULTS

Passed       Not Applicable

Type	Channel	Output power (dBm)	Limit (dBm)	Result
BT-BLE	00	-2.38	$\leq 30.00$	Pass
	19	-4.30		
	39	-3.45		

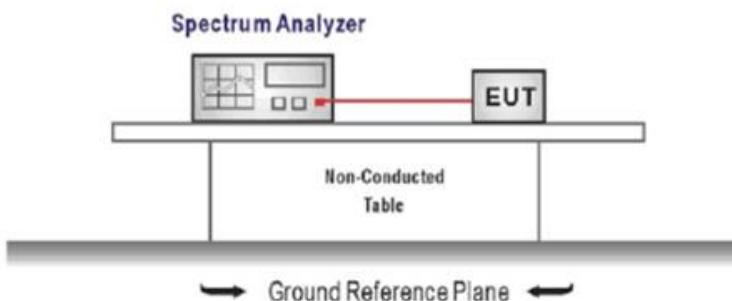
## 5.4. Power Spectral Density

### LIMIT

#### FCC CFR Title 47 Part 15 Subpart C Section 15.247 (e):

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.

### TEST CONFIGURATION



### TEST PROCEDURE

1. Connect the antenna port(s) to the spectrum analyzer input,
2. Configure the spectrum analyzer as shown below:  
 Center frequency=DTS channel center frequency  
 Span =1.5 times the DTS bandwidth  
 $RBW = 3 \text{ kHz} \leq RBW \leq 100 \text{ kHz}$ ,  $VBW \geq 3 \times RBW$   
 Sweep time = auto couple  
 Detector = peak  
 Trace mode = max hold
3. Place the radio in continuous transmit mode, allow the trace to stabilize, view the transmitter wave form on the spectrum analyzer.
4. Use the peak marker function to determine the maximum amplitude level within the RBW.
5. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

### TEST MODE:

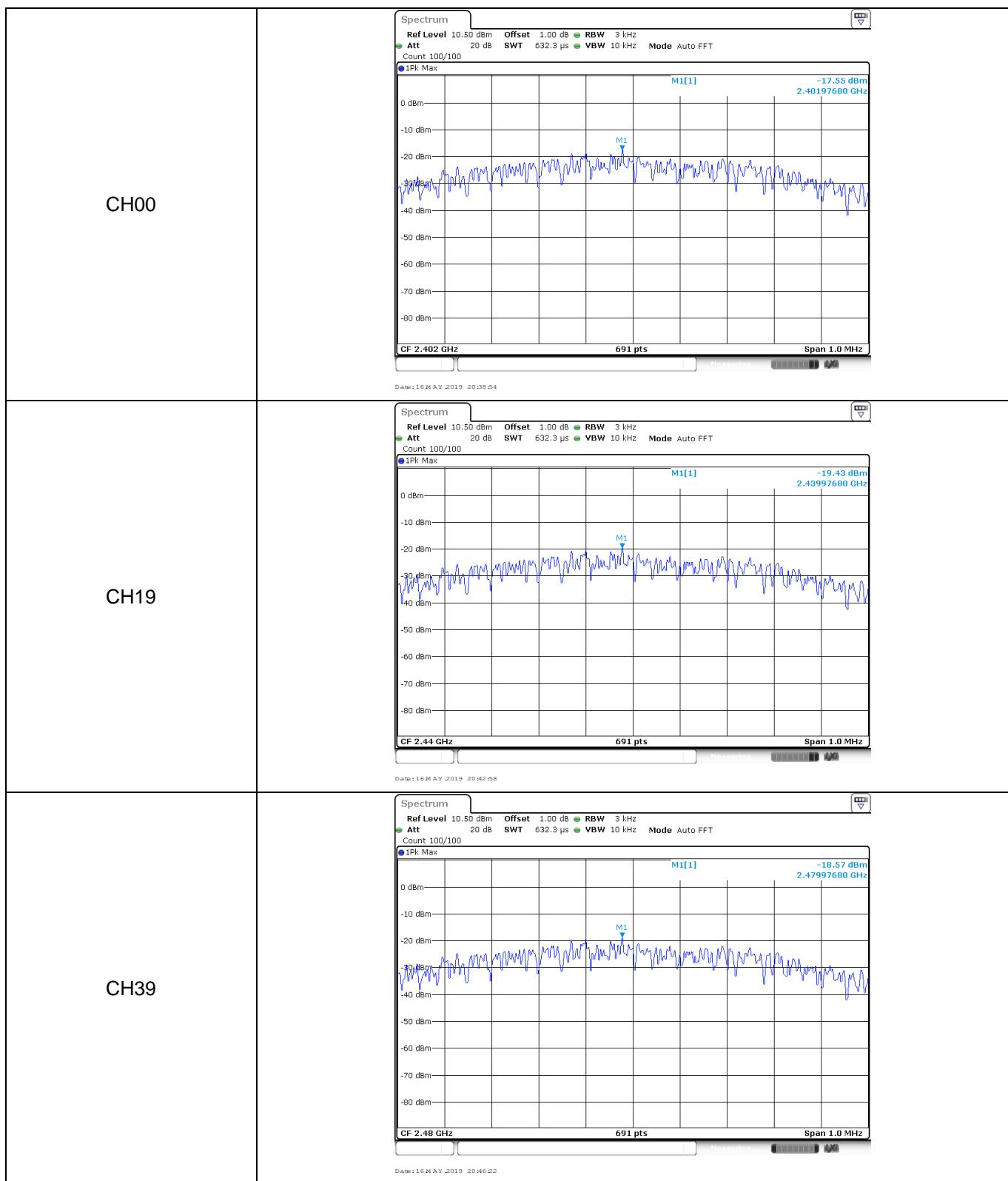
Please refer to the clause 3.3

### TEST RESULTS

Passed       Not Applicable

Type	Channel	Power Spectral Density(dBm/3KHz)	Limit (dBm/3KHz)	Result
BT-BLE	00	-17.55	$\leq 8.00$	Pass
	19	-19.43		
	39	-18.57		

Test plot as follows:



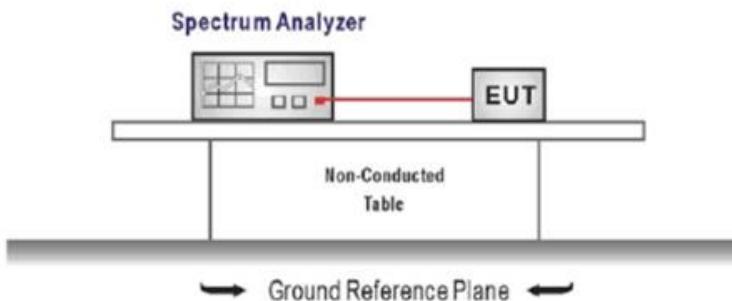
## 5.5. 6dB bandwidth

### LIMIT

#### FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(2):

For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

### TEST CONFIGURATION



### TEST PROCEDURE

1. Connect the antenna port(s) to the spectrum analyzer input.
2. Configure the spectrum analyzer as shown below (enter all losses between the transmitter output and the spectrum analyzer).
  - Center Frequency = DTS channel center frequency
  - Span=2 x DTS bandwidth
  - RBW = 100 kHz, VBW  $\geq 3 \times$  RBW
  - Sweep time= auto couple
  - Detector = Peak
  - Trace mode = max hold
3. Place the radio in continuous transmit mode, allow the trace to stabilize, view the transmitter waveform on the spectrum analyzer.
4. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission, and record the pertinent measurements.

### TEST MODE:

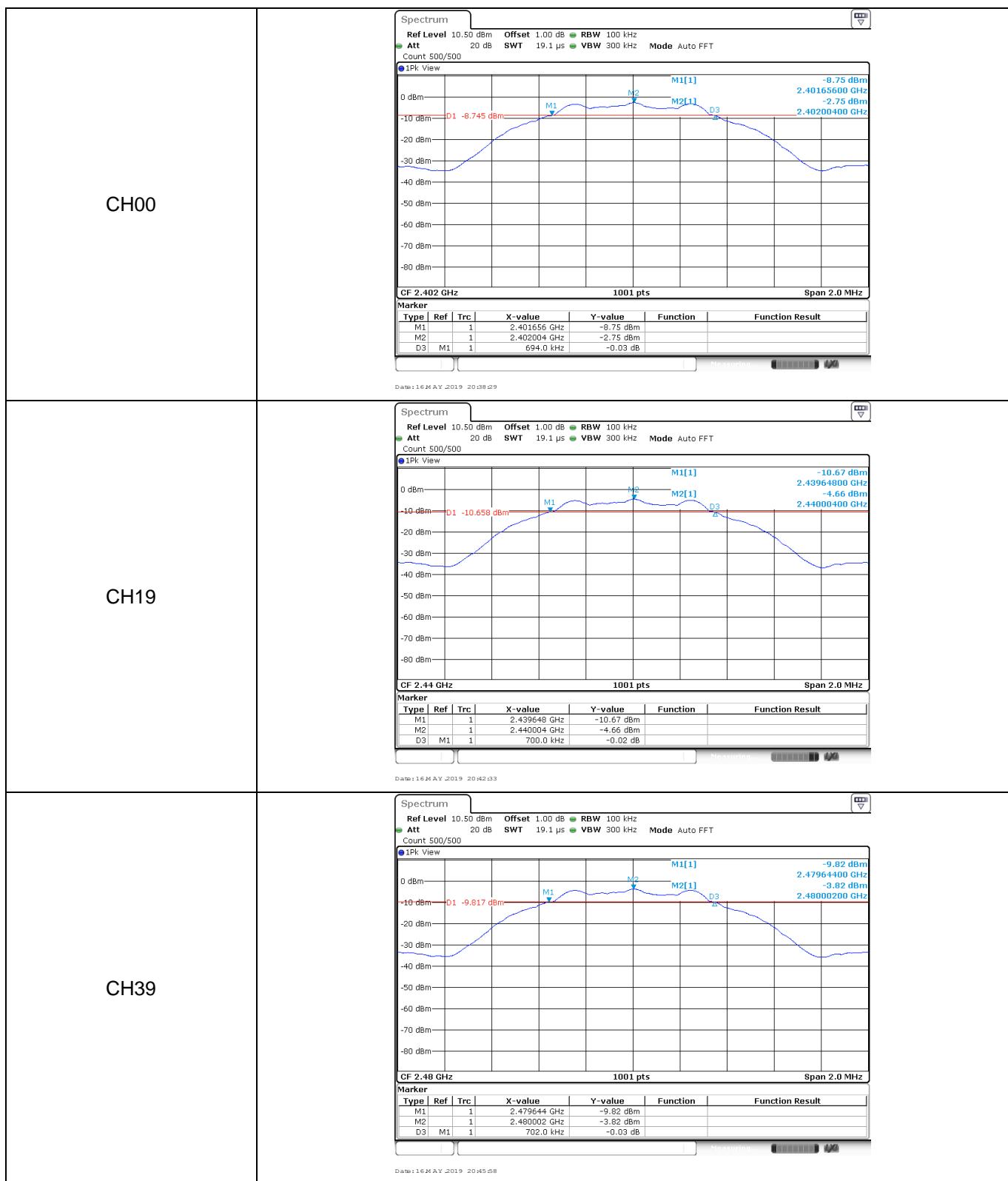
Please refer to the clause 3.3

### TEST RESULTS

Passed       Not Applicable

Type	Channel	6dB Bandwidth(MHz)	Limit (kHz)	Result
BT-BLE	00	0.69	$\geq 500$	Pass
	19	0.70		
	39	0.70		

Test plot as follows:



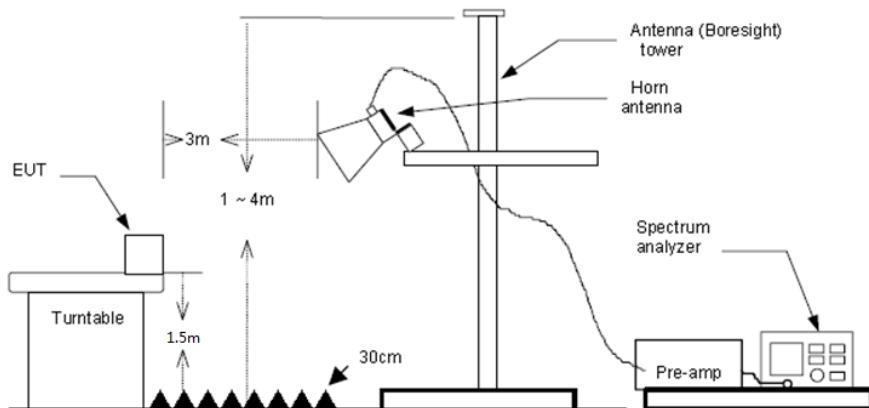
## 5.6. Restricted band

### LIMIT

#### FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d):

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, Radiated Emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the Radiated Emissions limits specified in §15.209(a) (see §15.205(c)).

### TEST CONFIGURATION



### TEST PROCEDURE

1. The EUT was setup and tested according to ANSI C63.10:2013 for compliance to FCC 47CFR 15.247 requirements.
2. The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.
5. The receiver set as follow:  
RBW=1MHz, VBW=3MHz Peak detector for Peak value.  
RBW=1MHz, VBW=3MHz RMS detector for Average value.

### TEST MODE:

Please refer to the clause 3.3

### TEST RESULTS

Passed       Not Applicable

#### Note:

- 1) Final level= Read level + Antenna Factor+ Cable Loss- Preamp Factor
- 2) The peak level is lower than average limit(54 dBuV/m), this data is the too weak instrument of signal is unable to test.

Test channel					CH00				
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
2310.00	33.80	28.05	6.62	37.59	30.88	74.00	-43.12	Vertical	Peak
2390.00	33.11	27.65	6.75	37.59	29.92	74.00	-44.08	Vertical	Peak
2310.00	32.59	28.05	6.62	37.59	29.67	74.00	-44.33	Horizontal	Peak
2390.00	32.65	27.65	6.75	37.59	29.46	74.00	-44.54	Horizontal	Peak
2310.00	26.35	28.05	6.62	37.59	23.43	54.00	-30.57	Vertical	Average
2390.00	26.20	27.65	6.75	37.59	23.01	54.00	-30.99	Vertical	Average
2310.00	24.93	28.05	6.62	37.59	22.01	54.00	-31.99	Horizontal	Average
2390.00	24.62	27.65	6.75	37.59	21.43	54.00	-32.57	Horizontal	Average

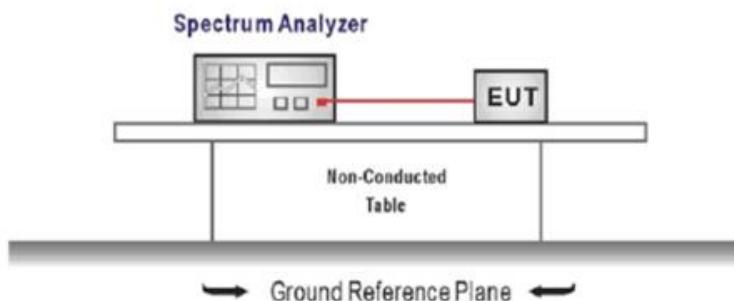
Test channel					CH39				
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
2483.50	48.65	27.26	6.83	37.59	45.15	74.00	-28.85	Vertical	Peak
2500.00	32.29	27.20	6.84	37.59	28.74	74.00	-45.26	Vertical	Peak
2483.50	47.40	27.26	6.83	37.59	43.90	74.00	-30.10	Horizontal	Peak
2500.00	31.73	27.20	6.84	37.59	28.18	74.00	-45.82	Horizontal	Peak
2483.50	46.47	27.26	6.83	37.59	42.97	54.00	-11.03	Vertical	Average
2500.00	25.02	27.20	6.84	37.59	21.47	54.00	-32.53	Vertical	Average
2483.50	44.95	27.26	6.83	37.59	41.45	54.00	-12.55	Horizontal	Average
2500.00	23.89	27.20	6.84	37.59	20.34	54.00	-33.66	Horizontal	Average

## 5.7. Band edge and Spurious Emissions (conducted)

### LIMIT

**FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d):** In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.

### TEST CONFIGURATION



### TEST PROCEDURE

1. Connect the antenna port(s) to the spectrum analyzer input.
2. Establish a reference level by using the following procedure
  - Center frequency=DTS channel center frequency
  - The span = 1.5 times the DTS bandwidth.
  - RBW = 100 kHz, VBW  $\geq 3 \times$  RBW
  - Detector = peak, Sweep time = auto couple, Trace mode = max hold
  - Allow trace to fully stabilize
  - Use the peak marker function to determine the maximum PSD level

Note that the channel found to contain the maximum PSD level can be used to establish the reference level.
3. Emission level measurement
  - Set the center frequency and span to encompass frequency range to be measured
  - RBW = 100 kHz, VBW  $\geq 3 \times$  RBW
  - Detector = peak, Sweep time = auto couple, Trace mode = max hold
  - Allow trace to fully stabilize
  - Use the peak marker function to determine the maximum amplitude level.
4. Place the radio in continuous transmit mode, allow the trace to stabilize, view the transmitter waveform on the spectrum analyzer.
5. Ensure that the amplitude of all unwanted emission outside of the authorized frequency band excluding restricted frequency bands) are attenuated by at least the minimum requirements specified (at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz). Report the three highest emission relative to the limit.

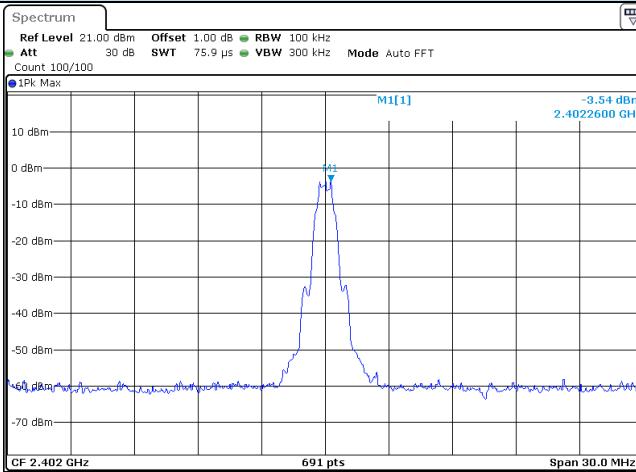
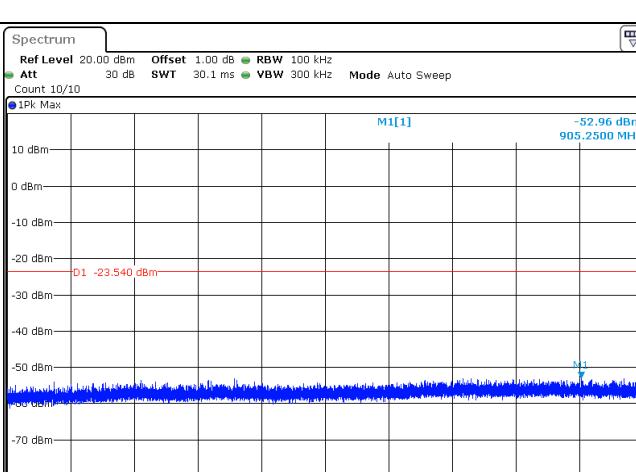
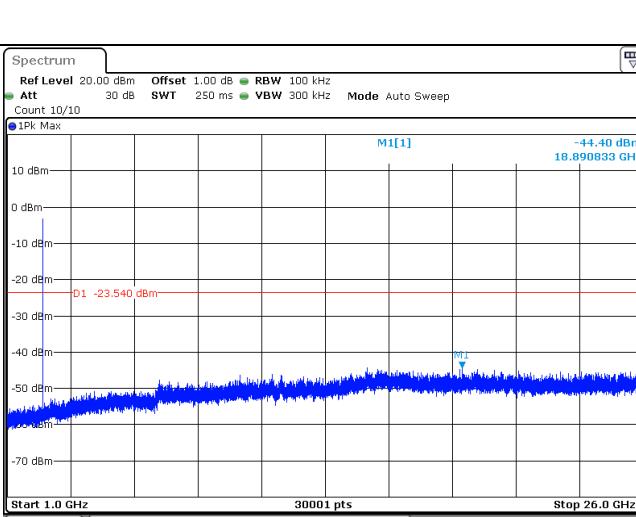
### TEST MODE:

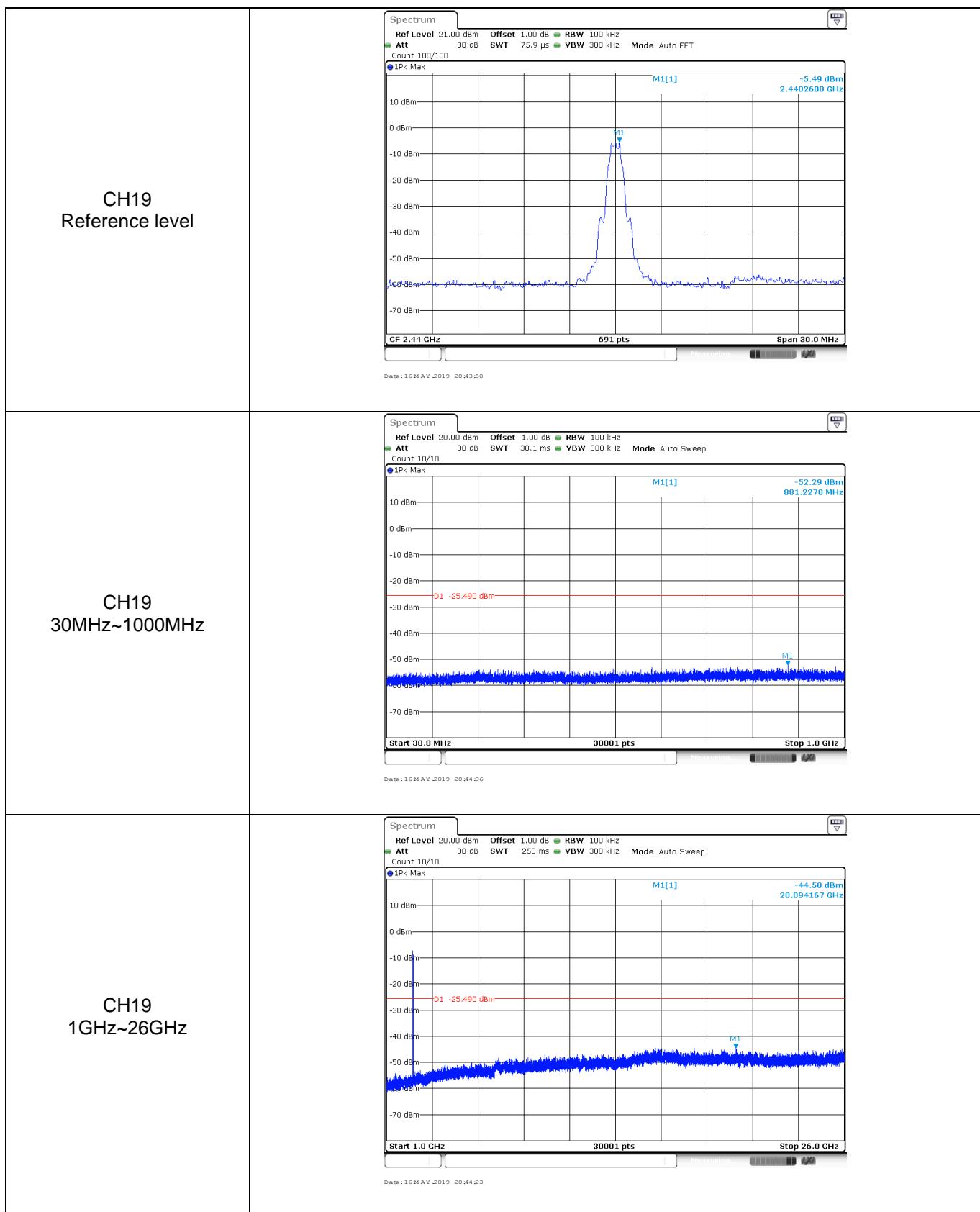
Please refer to the clause 3.3

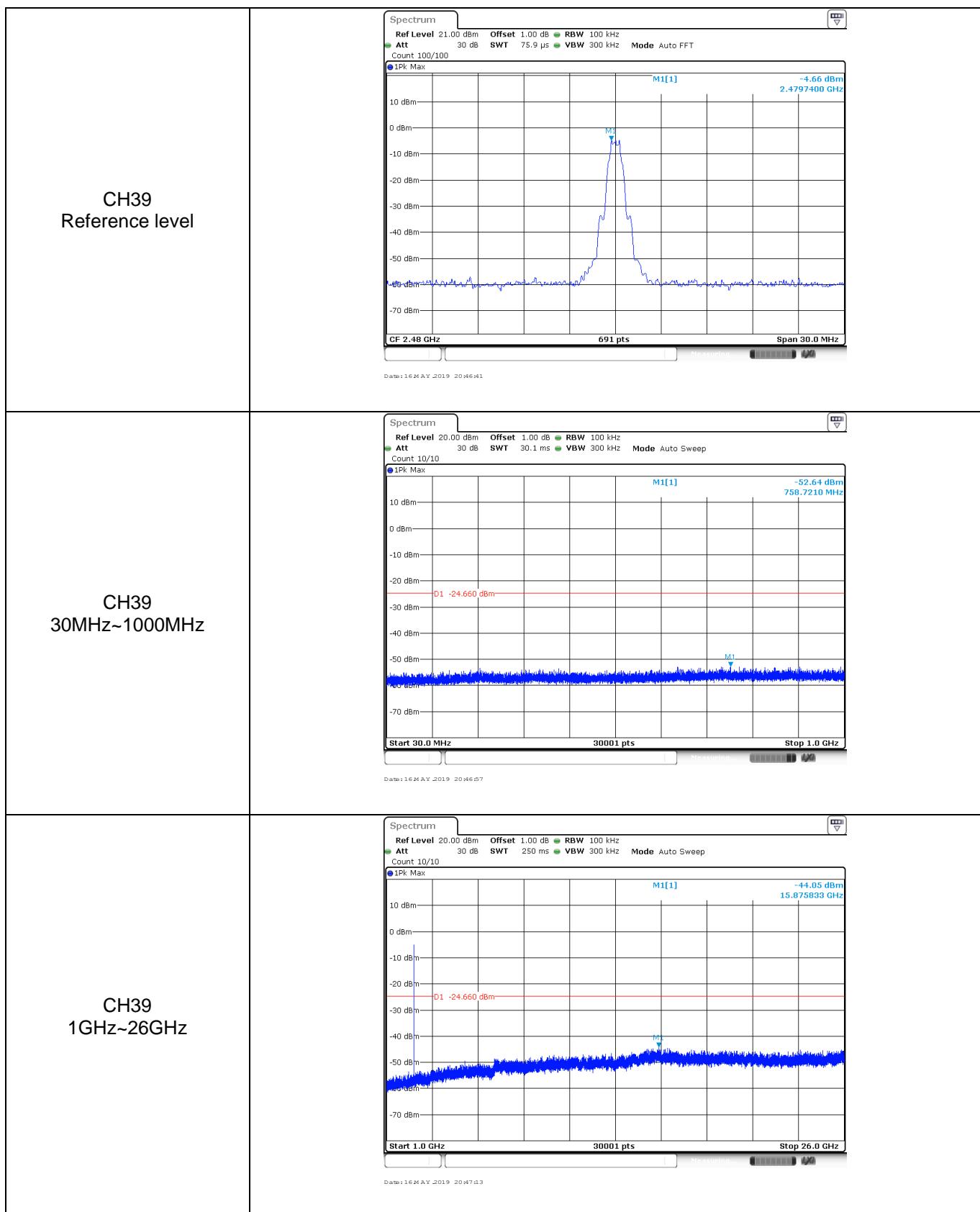
### TEST RESULTS

Passed       Not Applicable

Test Item:	Band edge																																										
CH00	<p><b>Spectrum</b></p> <p>Ref Level 10.50 dBm Offset 1.00 dB RBW 100 kHz    Att 20 dB SWT 1.1 ms VBW 300 kHz Mode Auto Sweep    Count 300/300</p> <p>1Pk Max</p> <p>M1[1] -3.07 dBm 2.402040 GHz    M2[1] -57.79 dBm 2.400000 GHz</p> <p>Start 2.31 GHz 691 pts Stop 2.405 GHz</p> <p>Marker</p> <table border="1"> <thead> <tr> <th>Type</th> <th>Ref</th> <th>Trc</th> <th>X-value</th> <th>Y-value</th> <th>Function</th> <th>Function Result</th> </tr> </thead> <tbody> <tr> <td>M1</td> <td>1</td> <td></td> <td>2.40204 GHz</td> <td>-3.07 dBm</td> <td></td> <td></td> </tr> <tr> <td>M2</td> <td>1</td> <td></td> <td>2.4 GHz</td> <td>-57.79 dBm</td> <td></td> <td></td> </tr> <tr> <td>M3</td> <td>1</td> <td></td> <td>2.39 GHz</td> <td>-65.94 dBm</td> <td></td> <td></td> </tr> <tr> <td>M4</td> <td>1</td> <td></td> <td>2.31 GHz</td> <td>-64.07 dBm</td> <td></td> <td></td> </tr> <tr> <td>M5</td> <td>1</td> <td></td> <td>2.399906 GHz</td> <td>-59.19 dBm</td> <td></td> <td></td> </tr> </tbody> </table> <p>Date: 16 MAY 2019 20:39:04</p>	Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1		2.40204 GHz	-3.07 dBm			M2	1		2.4 GHz	-57.79 dBm			M3	1		2.39 GHz	-65.94 dBm			M4	1		2.31 GHz	-64.07 dBm			M5	1		2.399906 GHz	-59.19 dBm		
Type	Ref	Trc	X-value	Y-value	Function	Function Result																																					
M1	1		2.40204 GHz	-3.07 dBm																																							
M2	1		2.4 GHz	-57.79 dBm																																							
M3	1		2.39 GHz	-65.94 dBm																																							
M4	1		2.31 GHz	-64.07 dBm																																							
M5	1		2.399906 GHz	-59.19 dBm																																							
CH39	<p><b>Spectrum</b></p> <p>Ref Level 10.50 dBm Offset 1.00 dB RBW 100 kHz    Att 20 dB SWT 56.9 µs VBW 300 kHz Mode Auto FFT    Count 100/100</p> <p>1Pk Max</p> <p>M1[1] -3.86 dBm 2.479990 GHz    M2[1] -66.58 dBm 2.483500 GHz</p> <p>Start 2.478 GHz 691 pts Stop 2.5 GHz</p> <p>Marker</p> <table border="1"> <thead> <tr> <th>Type</th> <th>Ref</th> <th>Trc</th> <th>X-value</th> <th>Y-value</th> <th>Function</th> <th>Function Result</th> </tr> </thead> <tbody> <tr> <td>M1</td> <td>1</td> <td></td> <td>2.47999 GHz</td> <td>-3.86 dBm</td> <td></td> <td></td> </tr> <tr> <td>M2</td> <td>1</td> <td></td> <td>2.4835 GHz</td> <td>-66.58 dBm</td> <td></td> <td></td> </tr> <tr> <td>M3</td> <td>1</td> <td></td> <td>2.5 GHz</td> <td>-69.07 dBm</td> <td></td> <td></td> </tr> <tr> <td>M4</td> <td>1</td> <td></td> <td>2.483771 GHz</td> <td>-66.61 dBm</td> <td></td> <td></td> </tr> </tbody> </table> <p>Date: 16 MAY 2019 20:46:32</p>	Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1		2.47999 GHz	-3.86 dBm			M2	1		2.4835 GHz	-66.58 dBm			M3	1		2.5 GHz	-69.07 dBm			M4	1		2.483771 GHz	-66.61 dBm									
Type	Ref	Trc	X-value	Y-value	Function	Function Result																																					
M1	1		2.47999 GHz	-3.86 dBm																																							
M2	1		2.4835 GHz	-66.58 dBm																																							
M3	1		2.5 GHz	-69.07 dBm																																							
M4	1		2.483771 GHz	-66.61 dBm																																							

Test Item:	SE
CH00 Reference level	 <p>Spectrum</p> <p>Ref Level 21.00 dBm Offset 1.00 dB RBW 100 kHz</p> <p>Att 30 dB SWT 75.9 <math>\mu</math>s VBW 300 kHz Mode Auto FFT</p> <p>Count 100/100</p> <p>1Pk Max</p> <p>M1[1] -3.54 dBm 2.4022600 GHz</p> <p>CF 2.402 GHz 691 pts Span 30.0 MHz</p> <p>Date: 16 MAY 2019 20:39:10</p>
CH00 30MHz~1000MHz	 <p>Spectrum</p> <p>Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz</p> <p>Att 30 dB SWT 30.1 ms VBW 300 kHz Mode Auto Sweep</p> <p>Count 10/10</p> <p>1Pk Max</p> <p>M1[1] -52.96 dBm 905.2500 MHz</p> <p>Start 30.0 MHz 30001 pts Stop 1.0 GHz</p> <p>Date: 16 MAY 2019 20:39:26</p>
CH00 1GHz~26GHz	 <p>Spectrum</p> <p>Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz</p> <p>Att 30 dB SWT 250 ms VBW 300 kHz Mode Auto Sweep</p> <p>Count 10/10</p> <p>1Pk Max</p> <p>M1[1] -44.40 dBm 18.890833 GHz</p> <p>Start 1.0 GHz 30001 pts Stop 26.0 GHz</p> <p>Date: 16 MAY 2019 20:39:42</p>





## 5.8. Spurious Emissions (radiated)

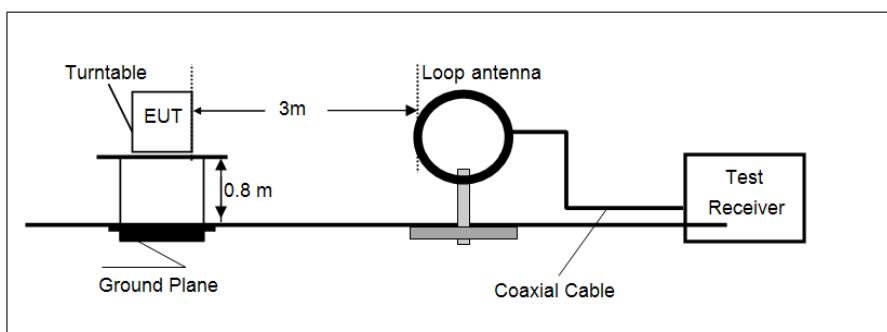
### LIMIT

#### FCC CFR Title 47 Part 15 Subpart C Section 15.209

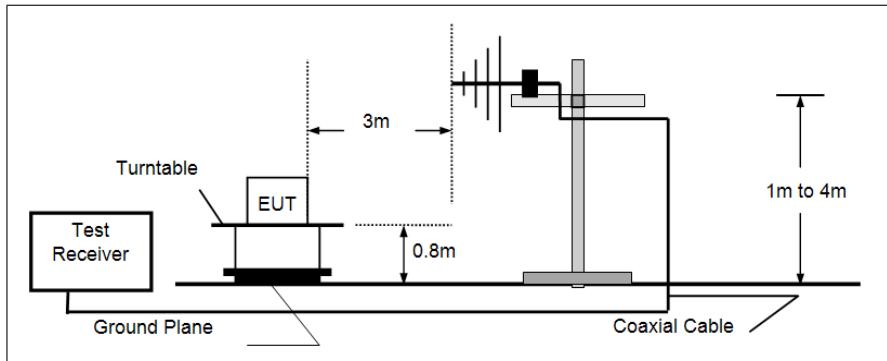
Frequency	Limit (dB <sub>UV</sub> /m @ 3m)	Value
30MHz~88MHz	40.00	Quasi-peak
88MHz~216MHz	43.50	Quasi-peak
216MHz~960MHz	46.00	Quasi-peak
960MHz~1GHz	54.00	Quasi-peak
Above 1GHz	54.00	Average
	74.00	Peak

### TEST CONFIGURATION

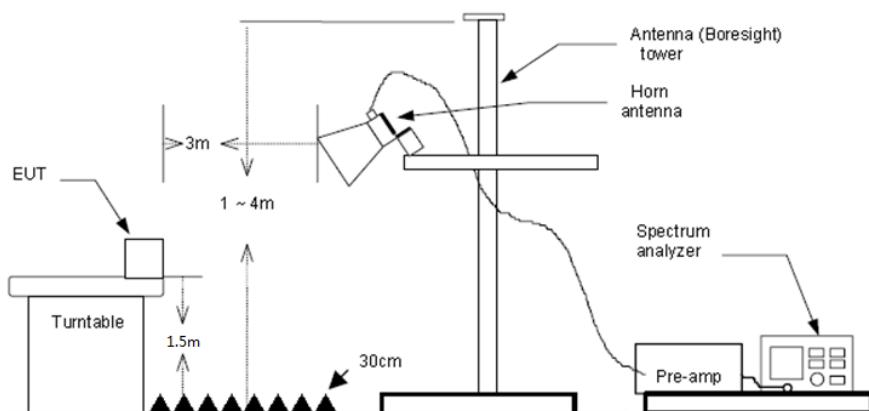
- 9 kHz ~ 30 MHz



- 30 MHz ~ 1 GHz



- Above 1 GHz



## TEST PROCEDURE

1. The EUT was setup and tested according to ANSI C63.10:2013 for compliance to FCC 47CFR 15.247 requirements.
2. The EUT is placed on a turn table which is 0.8 meter above ground for below 1 GHz, and 1.5 m for above 1 GHz. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was set 3 meters from the receiving antenna, which was mounted on the top of a variable height antenna tower.
4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Use the following spectrum analyzer settings
  - (1) Span shall wide enough to fully capture the emission being measured;
  - (2) Below 1 GHz:  
RBW=120 kHz, VBW=300 kHz, Sweep=auto, Detector function=peak, Trace=max hold;  
If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
  - (3) From 1 GHz to 10<sup>th</sup> harmonic:  
RBW=1MHz, VBW=3MHz Peak detector for Peak value.  
RBW=1MHz, VBW=3MHz RMS detector for Average value.

## TEST MODE:

Please refer to the clause 3.3

## TEST RESULTS

Passed       Not Applicable

### Note:

- 1) Above 1GHz Final Level =Receiver Read level + Factor
- 2) The emission levels of other frequencies are very lower than the limit and not show in test report.

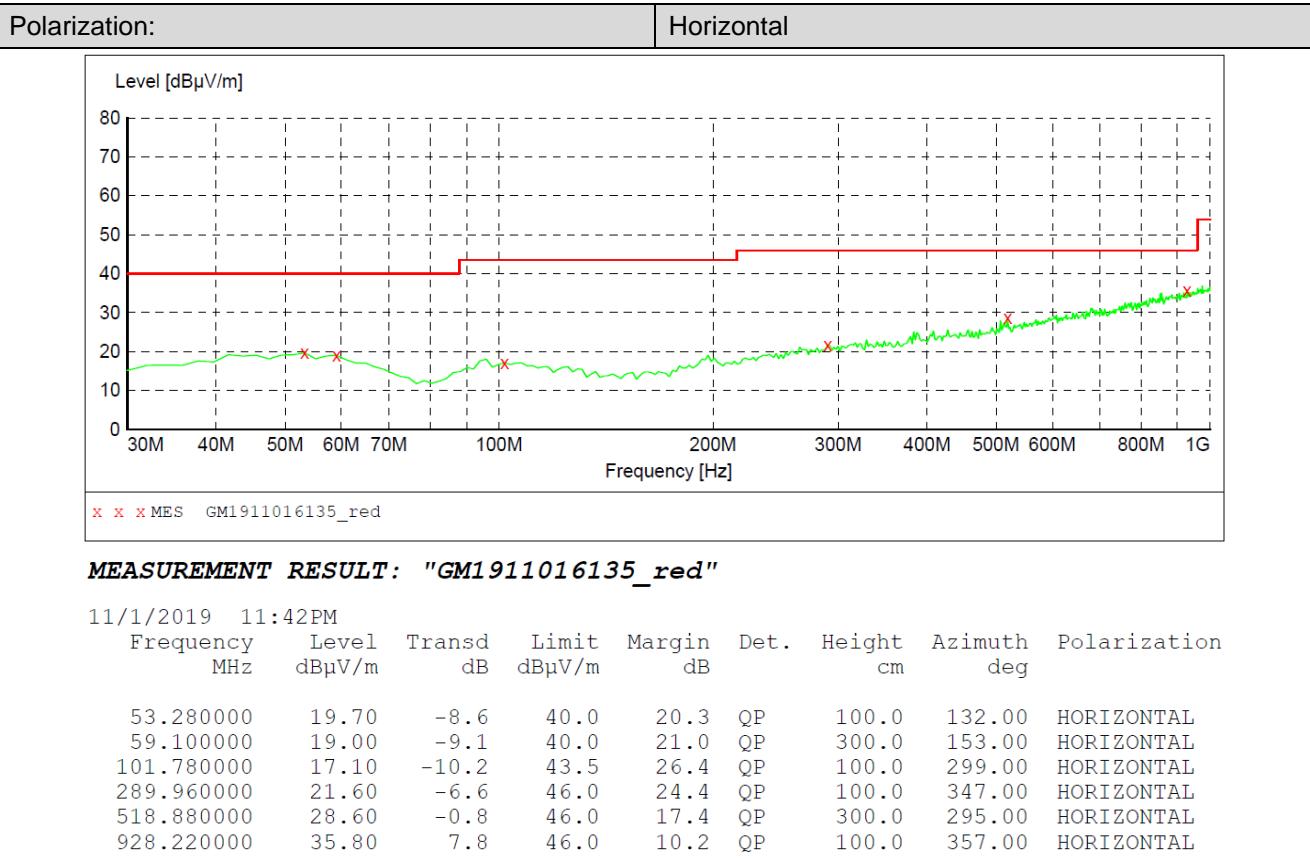
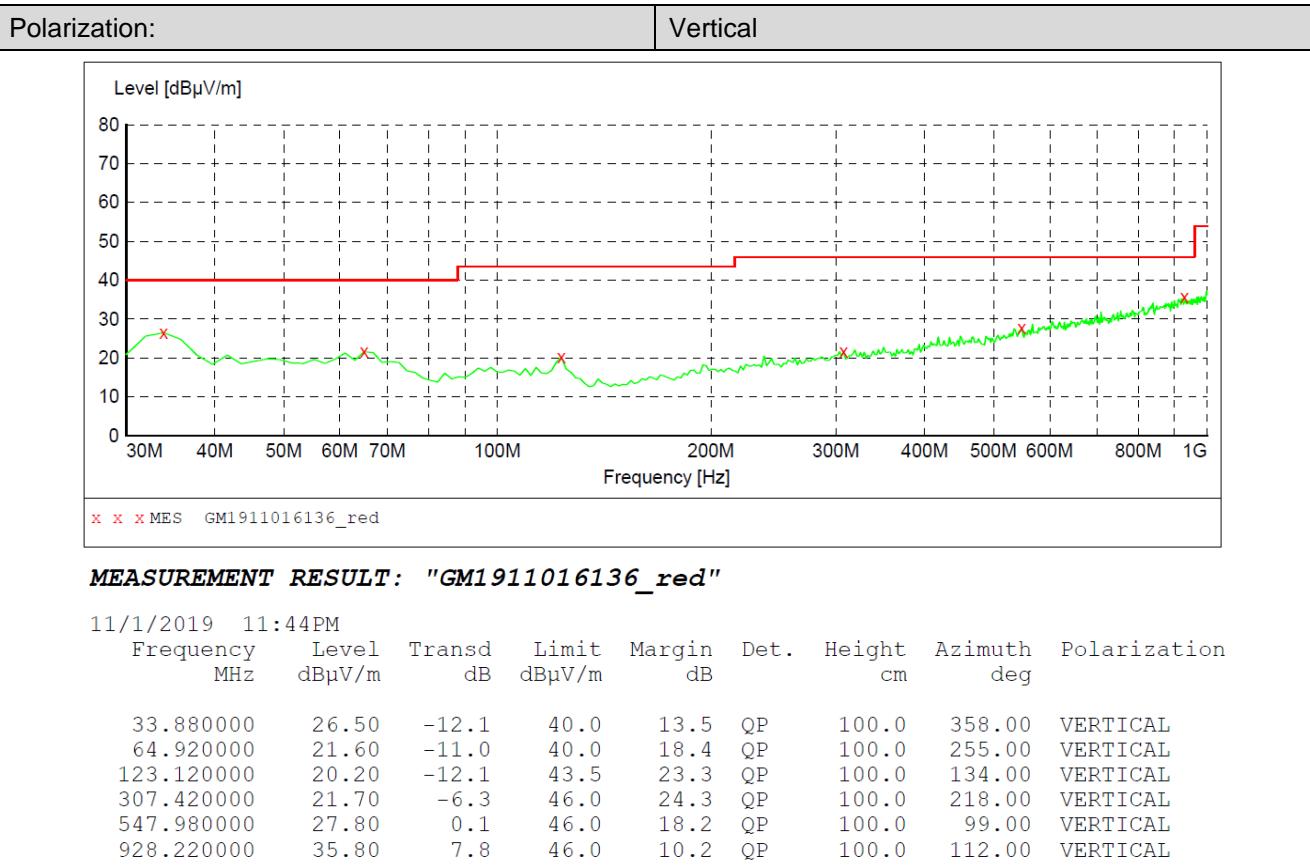
➤ **9 kHz ~ 30 MHz**

The EUT was pre-scanned the frequency band (9 kHz ~ 30 MHz), found the radiated level lower than the limit, so don't show on the report.

➤ **30 MHz ~ 1000 MHz**

Have pre-scan all modulation mode, found the BT-BLE mode CH39 which it was worst case, so only the worst case's data on the test report.

## &gt; 30 MHz ~ 1 GHz



## ➤ 1 GHz ~ 25 GHz

Test channel			CH00				
Freq. [MHz]	Reading [dB $\mu$ V/m]	Factor [dB]	Level [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]	Polarity	Detector
1630.093	33.80	-6.23	27.57	74.00	46.43	Horizontal	PK
3200.187	36.11	0.84	36.95	74.00	37.05	Horizontal	PK
5234.406	31.33	8.80	40.13	74.00	33.87	Horizontal	PK
7923.687	29.93	17.52	47.45	74.00	26.55	Horizontal	PK
Test channel			CH19				
Freq. [MHz]	Reading [dB $\mu$ V/m]	Factor [dB]	Level [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]	Polarity	Detector
1753.468	34.00	-5.94	28.06	74.00	45.94	Horizontal	PK
3831.750	32.54	2.21	34.75	74.00	39.25	Horizontal	PK
6689.937	30.16	13.44	43.60	74.00	30.40	Horizontal	PK
8067.625	30.79	16.29	47.08	74.00	26.92	Horizontal	PK
Test channel			CH39				
Freq. [MHz]	Reading [dB $\mu$ V/m]	Factor [dB]	Level [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]	Polarity	Detector
1490.562	33.16	-5.63	27.53	74.00	46.47	Horizontal	PK
2796.281	31.62	2.03	33.65	74.00	40.35	Horizontal	PK
6322.750	30.32	11.06	41.38	74.00	32.62	Horizontal	PK
8643.375	31.03	15.97	47.00	74.00	27.00	Horizontal	PK
Test channel			CH39				
Freq. [MHz]	Reading [dB $\mu$ V/m]	Factor [dB]	Level [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]	Polarity	Detector
1514.062	33.15	-5.72	27.43	74.00	46.57	Vertical	PK
3513.031	32.47	1.10	33.57	74.00	40.43	Vertical	PK
5357.781	31.47	8.55	40.02	74.00	33.98	Vertical	PK
7494.812	30.30	15.41	45.71	74.00	28.29	Vertical	PK

## Remark:

- Final Level =Receiver Read level + Factor
- The peak level is lower than average limit(54dB $\mu$ V/m), this data is the too weak instrument of signal is unable to test.
- The emission levels of other frequencies are very lower than the limit and not show in test report.

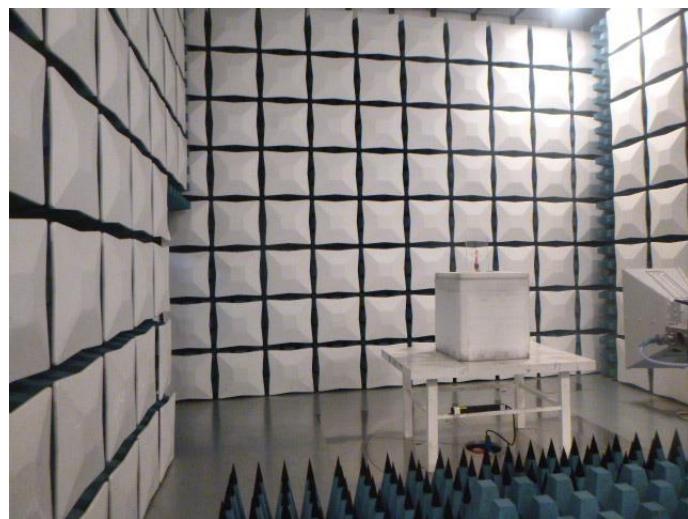
## 6. TEST SETUP PHOTOS

Conducted Emissions (AC Mains)



Radiated Emissions





## **7. EXTERANAL AND INTERNAL PHOTOS**

Reference to the test report No.: CHTEW19110062

-----End of Report-----