

**Shenzhen Global Test Service Co.,Ltd.**

1F, Building No. 13A, Zhonghaixin Science and Technology City, No.12,6 Road, Ganli Industrial Park, Buji Street, Longgang District, Shenzhen, Guangdong

FCC PART 15 SUBPART C TEST REPORT**FCC PART 15.247****Report Reference No.**.....: **GTSR16120185-01****FCC ID**.....: **2AKWA-M82RS02**

Compiled by

(position+printed name+signature)..: File administrators Jimmy Wang

Supervised by

(position+printed name+signature)..: Test Engineer Peter Xiao

Approved by

(position+printed name+signature)..: Manager Sam Wang

Date of issue.....: Feb. 18, 2017

Representative Laboratory Name .: **Shenzhen Global Test Service Co.,Ltd.**Address: 1F, Building No. 13A, Zhonghaixin Science and Technology City,
No.12,6 Road, Ganli Industrial Park, Buji Street, Longgang District,
Shenzhen, Guangdong**Applicant's name**.....: **Shenzhen Mcking Information Technology Co.,Ltd**Address: Room1203,12F,Building A2,Lilang Software Park NO.31Bulan
Road, Longgang District, Shenzhen,China.**Test specification**Standard: **FCC Part 15.247-2015: Operation within the bands 902-928
MHz, 2400-2483.5 MHz and 5725-5850 MHz**

TRF Originator.....: Shenzhen Global Test Service Co.,Ltd.

Master TRF.....: Dated 2014-12

Shenzhen Global Test Service Co.,Ltd. All rights reserved.

This publication may be reproduced in whole or in part for non-commercial purposes as long as the Shenzhen Global Test Service Co.,Ltd. is acknowledged as copyright owner and source of the material. Shenzhen Global Test Service Co.,Ltd. takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.

Test item description: Gateway

Trade Mark: /

Manufacturer: **Shenzhen Mcking Information Technology Co.,Ltd**

Model/Type reference.....: M82RS02

Listed Models: M82RS03, M82RS04, M82RS05, M82RS06, M82RS07, M82RS08,
M82RS09

Modulation Type.....: GFSK

Operation Frequency.....: From 2406MHz to 2481MHz

EUT Type: Production Unit

Hardware Version: 102RS162V21

Software Version: V1.0

Rating: DC 12V

Result.....: **PASS**

TEST REPORT

Test Report No. : GTSR16120185-01	Feb. 18, 2017
	Date of issue

Equipment under Test : Gateway

Model /Type : M82RS02

Listed Models : M82RS03, M82RS04, M82RS05, M82RS06, M82RS07, M82RS08, M82RS09

Applicant : **Shenzhen Mcking Information Technology Co.,Ltd**

Address : Room1203,12F,Building A2,Lilang Software Park NO.31Bulan
Road, Longgang District, Shenzhen,China.

Manufacturer : **Shenzhen Mcking Information Technology Co.,Ltd**

Address : Room1203,12F,Building A2,Lilang Software Park NO.31Bulan
Road, Longgang District, Shenzhen,China.

Test Result:	PASS
--------------	------

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Contents

1.	<u>TEST STANDARDS</u>	<u>4</u>
2.	<u>SUMMARY</u>	<u>5</u>
2.1.	General Remarks	5
2.2.	Product Description	5
2.3.	Equipment Under Test	5
2.4.	Short description of the Equipment under Test (EUT)	5
2.5.	EUT operation mode	5
2.6.	Block Diagram of Test Setup	6
2.7.	Related Submittal(s) / Grant (s)	6
2.8.	EUT configuration	6
2.9.	Modifications	6
3.	<u>TEST ENVIRONMENT</u>	<u>7</u>
3.1.	Address of the test laboratory	7
3.2.	Test Facility	7
3.3.	Environmental conditions	7
3.4.	Test Description	8
3.5.	Statement of the measurement uncertainty	8
3.6.	Equipments Used during the Test	9
4.	<u>TEST CONDITIONS AND RESULTS.....</u>	<u>10</u>
4.1.	AC Power Conducted Emission	10
4.2.	Radiated Emission.....	13
4.3.	Maximum Peak Output Power.....	18
4.4.	Power Spectral Density	20
4.5.	6dB Bandwidth	24
4.6.	Band Edge Compliance of RF Emission	28
4.7.	Spurious RF Conducted Emission	31
4.8.	Antenna Requirement.....	50
5.	<u>TEST SETUP PHOTOS OF THE EUT</u>	<u>51</u>
6.	<u>EXTERNAL AND INTERNAL PHOTOS OF THE EUT</u>	<u>53</u>

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

[KDB558074 D01 V03r05](#): Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247.

2. SUMMARY

2.1. General Remarks

Date of receipt of test sample	:	Dec. 29, 2016
Testing commenced on	:	Dec. 29, 2016
Testing concluded on	:	Feb. 18, 2017

2.2. Product Description

Name of EUT	Gateway
Trade Mark	/
Model Number	M82RS02
List Model	M82RS03,M82RS04,M82RS05,M82RS06, M82RS07, M82RS08, M82RS09
FCC ID	2AKWA-M82RS02
Antenna Type	Internal Antenna
Operation frequency	2406MHz-2481MHz
Modulation	GFSK
Channel separation	5MHz
Antenna gain	2.04dBi
Remark: The products are identical in interior structure, electrical circuits and components, just model names and color are different.	

2.3. Equipment Under Test

Power supply system utilised

Power supply voltage	:	☐ 230V / 50 Hz	☐ 120V / 60Hz
		☒ 12 V DC	☐ 24 V DC
		☐ Other (specified in blank below)	

/

2.4. Short description of the Equipment under Test (EUT)

This is a Gateway.

For more details, refer to the user's manual of the EUT.

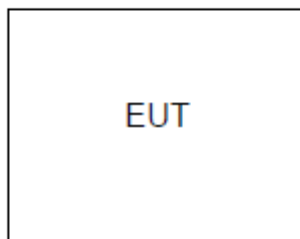
2.5. EUT operation mode

The Applicant provides communication tools software to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and receiving mode for testing .There are 16 channels provided to the EUT.

Channel 0/7/15 was selected to test.

Channel	Frequency(MHz)	Channel	Frequency(MHz)
0	2406	8	2446
1	2411	9	2451
2	2416	10	2456
3	2421	11	2461
4	2426	12	2466
5	2431	13	2471
6	2436	14	2476
7	2441	15	2481

2.6. Block Diagram of Test Setup



2.7. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: 2AKWA-M82RS02** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

2.8. EUT configuration

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

● - supplied by the manufacturer

○ - Supplied by the lab

○	Adapter	M/N:	AOP020-122C
		Manufacturer:	Yanll

2.9. Modifications

No modifications were implemented to meet testing criteria.

3. TEST ENVIRONMENT

3.1. Address of the test laboratory

Shenzhen Global Test Service Co.,Ltd.

1F, Building No. 13A, Zhonghaixin Science and Technology City, No.12,6 Road, Ganli Industrial Park, Buji Street, Longgang District, Shenzhen, Guangdong

Shenzhen CTL Testing Technology Co., Ltd.

1/F.-A, Baisha Technology Park, No.3011, Shahexi Road, Nanshan District, Shenzhen, Guangdong, China

3.2. Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

FCC-Registration No.: 964637

Shenzhen Global Test Service 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. Registration 964637, Jul 24, 2015.

CNAS-Lab Code: L8169

Shenzhen Global Test Service Co.,Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories. Date of Registration: Dec. 11, 2015. Valid time is until Dec. 10, 2018.

FCC-Registration No.: 970318

Shenzhen CTL Testing Technology 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. Registration 970318, December 19, 2013.

3.3. Environmental conditions

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

Temperature:	15-35 ° C
Humidity:	30-60 %
Atmospheric pressure:	950-1050mbar

3.4. Test Description

Test Specification clause	Test case	Test Mode	Test Channel	Recorded In Report		Pass	Fail	NA	NP	Remark
§15.247(b)(4)	Antenna gain	GFSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Lowest ☒ Middle ☒ Highest	☒	☐	☐	☐	complies
§15.247(e)	Power spectral density	GFSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Lowest ☒ Middle ☒ Highest	☒	☐	☐	☐	complies
§15.247(a)(2)	Spectrum bandwidth – 6 dB bandwidth	GFSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Lowest ☒ Middle ☒ Highest	☒ ☒	☐	☐	☐	complies
§15.247(b)(1)	Maximum output power	GFSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Lowest ☒ Middle ☒ Highest	☒ ☒ ☒	☐	☐	☐	complies
§15.247(d)	Band edge compliance conducted	GFSK	☒ Lowest ☒ Highest	GFSK	☒ Lowest ☒ Highest	☒ ☒	☐	☐	☐	complies
§15.205	Band edge compliance radiated	GFSK	☒ Lowest ☒ Highest	GFSK	☒ Lowest ☒ Highest	☒	☐	☐	☐	complies
§15.247(d)	TX spurious emissions conducted	GFSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Lowest ☒ Middle ☒ Highest	☒ ☒	☐	☐	☐	complies
§15.247(d)	TX spurious emissions radiated	GFSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Lowest ☒ Middle ☒ Highest	☒	☐	☐	☐	complies
§15.109	RX spurious emissions radiated	-/-	-/-	-/-	-/-	☐	☐	☒	☐	complies
§15.209(a)	TX spurious Emissions radiated < 30 MHz	GFSK	-/-	GFSK	-/-	☒	☐	☐	☐	complies
§15.107(a) §15.207	Conducted Emissions < 30 MHz	GFSK	-/-	GFSK	-/-	☒	☐	☐	☐	complies

Remark:

1. The measurement uncertainty is not included in the test result.
2. NA = Not Applicable; NP = Not Performed

3.5. 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 within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen Global Test Service Co.,Ltd. quality system acc. to DIN EN 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.

Hereafter the best measurement capability for Shenzhen GTS laboratory is reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	4.10 dB	(1)
Radiated Emission	1~18GHz	4.32 dB	(1)
Radiated Emission	18-40GHz	5.54 dB	(1)
Conducted Disturbance	0.15~30MHz	3.12 dB	(1)

- (1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

3.6. Equipments Used during the Test

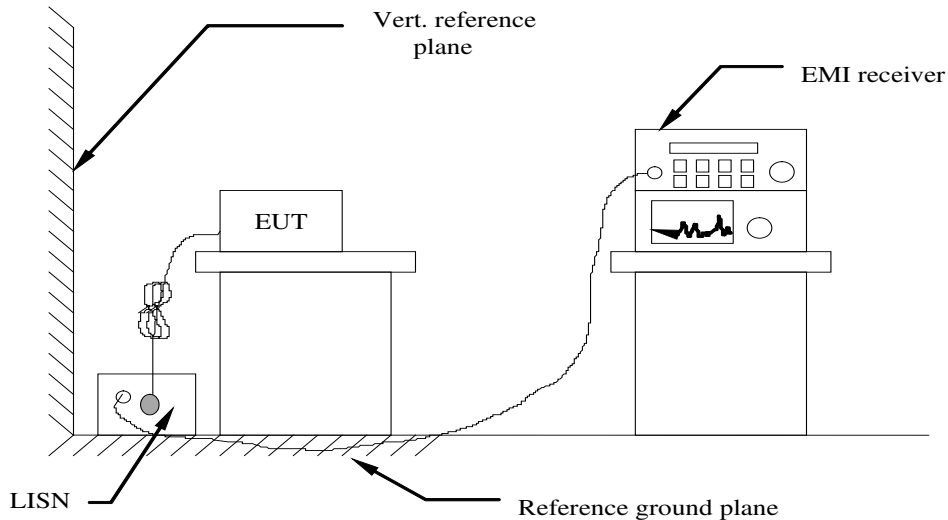
Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
LISN	R&S	ENV216	3560.6550.08	2016/05/28	2017/05/27
LISN	R&S	ESH2-Z5	893606/008	2016/05/27	2017/05/26
Bilog Antenna	Sunol Sciences Corp.	JB1	A061713	2016/06/02	2017/06/01
EMI Test Receiver	R&S	ESCI	101102	2016/06/26	2017/06/25
Spectrum Analyzer	Agilent	N9020A	MY48010425	2016/06/17	2017/06/16
Controller	EM Electronics	Controller EM 1000	N/A	2016/05/21	2017/05/20
Horn Antenna	Sunol Sciences Corp.	DRH-118	A062013	2016/05/19	2017/05/18
Active Loop Antenna	SCHWARZBEC K	FMZB1519	1519-037	2016/05/19	2017/05/18
Amplifier	Agilent	8349B	3008A02306	2016/05/19	2017/05/18
Amplifier	Agilent	8447D	2944A10176	2016/05/19	2017/05/18
Temperature/Humidity Meter	Gangxing	CTH-608	02	2016/05/20	2017/05/19
High-Pass Filter	K&L	9SH10-2700/X12750-O/O	N/A	2016/05/20	2017/05/19
High-Pass Filter	K&L	41H10-1375/U12750-O/O	N/A	2016/05/20	2017/05/19
RF Cable	HUBER+SUHNER	RG214	N/A	2016/05/20	2017/05/19
Data acquisition card	Agilent	U2531A	TW53323507	2016/05/20	2017/05/19
Power Sensor	Agilent	U2021XA	MY5365004	2016/05/20	2017/05/19

Note: The Cal.Interval was one year.

4. TEST CONDITIONS AND RESULTS

4.1. AC Power Conducted Emission

TEST CONFIGURATION



TEST PROCEDURE

- 1 The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10-2013.
- 2 Support equipment, if needed, was placed as per ANSI C63.10-2013
- 3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2013
- 4 The EUT received DC 12V power, the adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
- 5 All support equipments received AC power from a second LISN, if any.
- 6 The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
- 7 Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
- 8 During the above scans, the emissions were maximized by cable manipulation.

AC Power Conducted Emission Limit

For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following :

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.

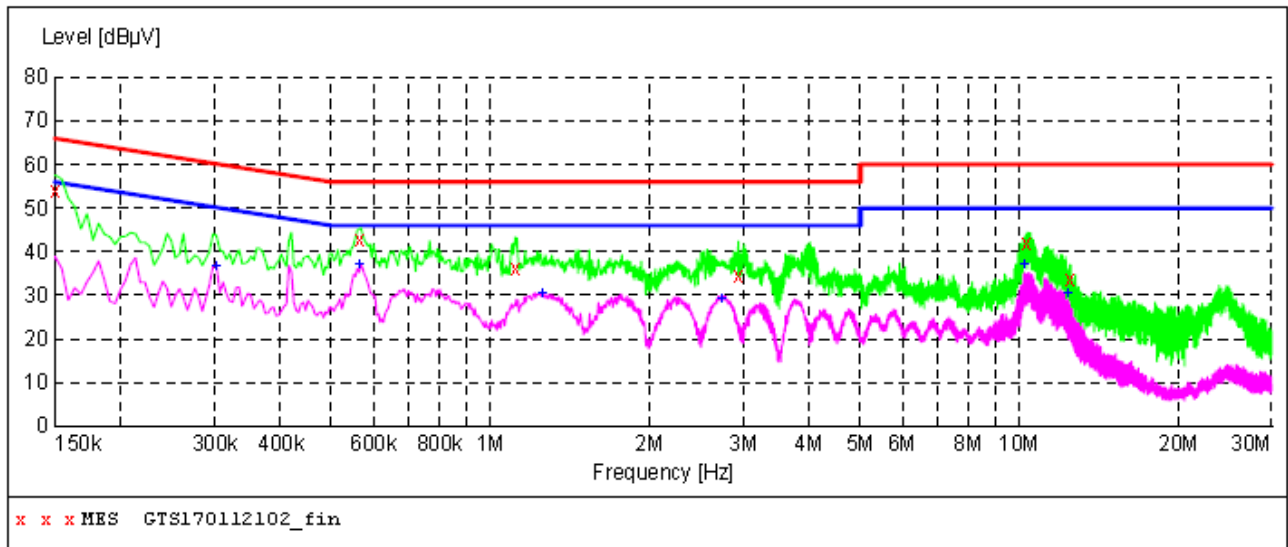
TEST RESULTS

Power supply:

DC 12V from Adapter
AC 120V/60Hz

Polarization

L

**MEASUREMENT RESULT: "GTS170112102_fin"**

1/12/2017 10:17AM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.150000	54.20	10.1	66	11.8	QP	L1	GND
0.564000	42.90	9.7	56	13.1	QP	L1	GND
1.117500	36.10	9.6	56	19.9	QP	L1	GND
2.935500	34.70	9.5	56	21.3	QP	L1	GND
10.356000	42.00	8.8	60	18.0	QP	L1	GND
12.498000	33.70	8.5	60	26.3	QP	L1	GND

MEASUREMENT RESULT: "GTS170112102_fin2"

1/12/2017 10:17AM

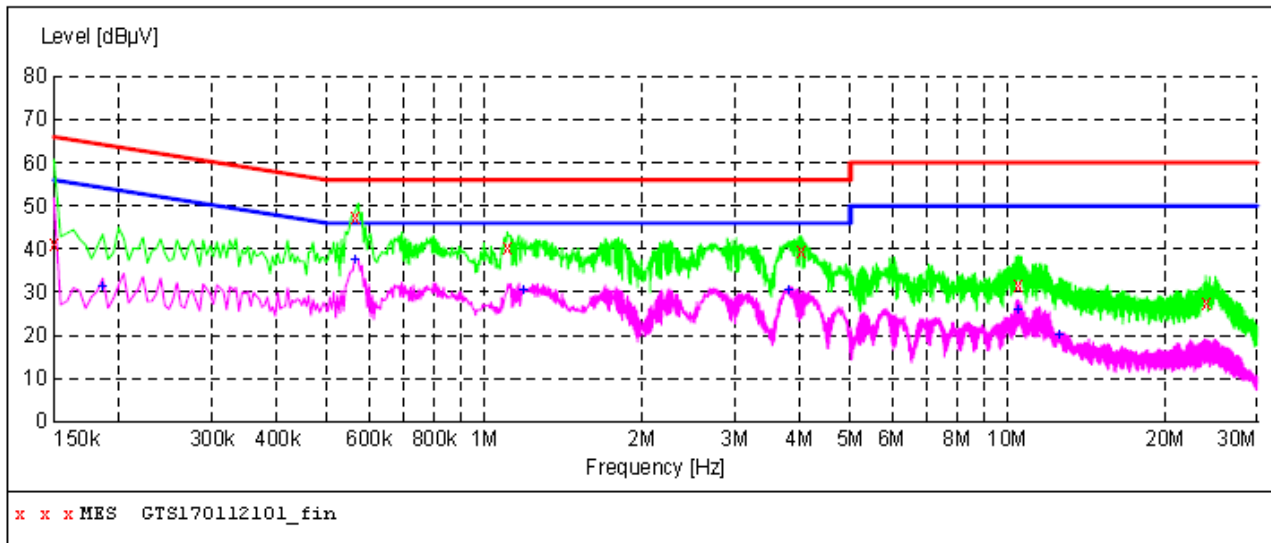
Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.303000	36.40	9.9	50	13.8	AV	L1	GND
0.564000	36.90	9.7	46	9.1	AV	L1	GND
1.252500	30.30	9.6	46	15.7	AV	L1	GND
2.737500	29.30	9.5	46	16.7	AV	L1	GND
10.203000	37.20	8.9	50	12.8	AV	L1	GND
12.376500	30.50	8.5	50	19.5	AV	L1	GND

Power supply:

DC 12V from Adapter
AC 120V/60Hz

Polarization

N

**MEASUREMENT RESULT: "GTS170112101_fin"**

1/12/2017 10:12AM

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.150000	41.20	10.1	66	24.8	QP	N	GND
0.564000	47.40	9.7	56	8.6	QP	N	GND
1.108500	40.40	9.6	56	15.6	QP	N	GND
4.024500	39.30	9.4	56	16.7	QP	N	GND
10.504500	31.80	8.8	60	28.2	QP	N	GND
23.937000	27.30	7.0	60	32.7	QP	N	GND

MEASUREMENT RESULT: "GTS170112101_fin2"

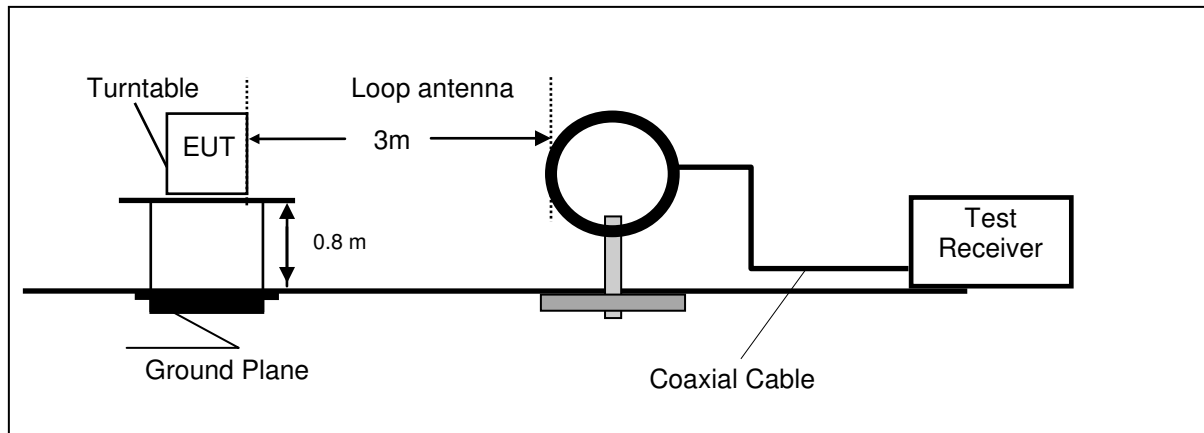
1/12/2017 10:12AM

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.186000	31.40	10.0	54	22.8	AV	N	GND
0.564000	37.50	9.7	46	8.5	AV	N	GND
1.180500	30.20	9.6	46	15.8	AV	N	GND
3.822000	30.50	9.4	46	15.5	AV	N	GND
10.441500	26.00	8.8	50	24.0	AV	N	GND
12.552000	20.20	8.5	50	29.8	AV	N	GND

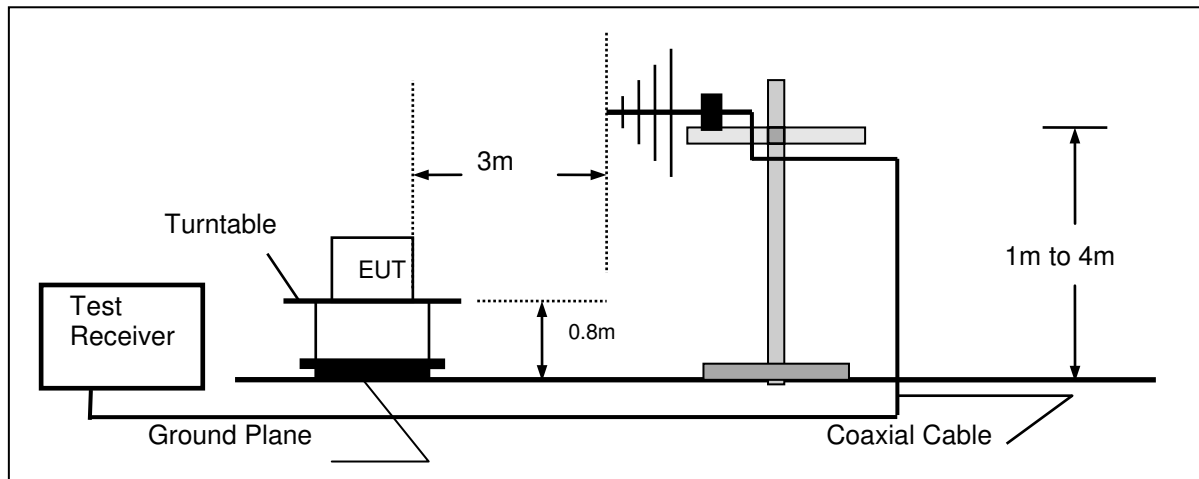
4.2. Radiated Emission

TEST CONFIGURATION

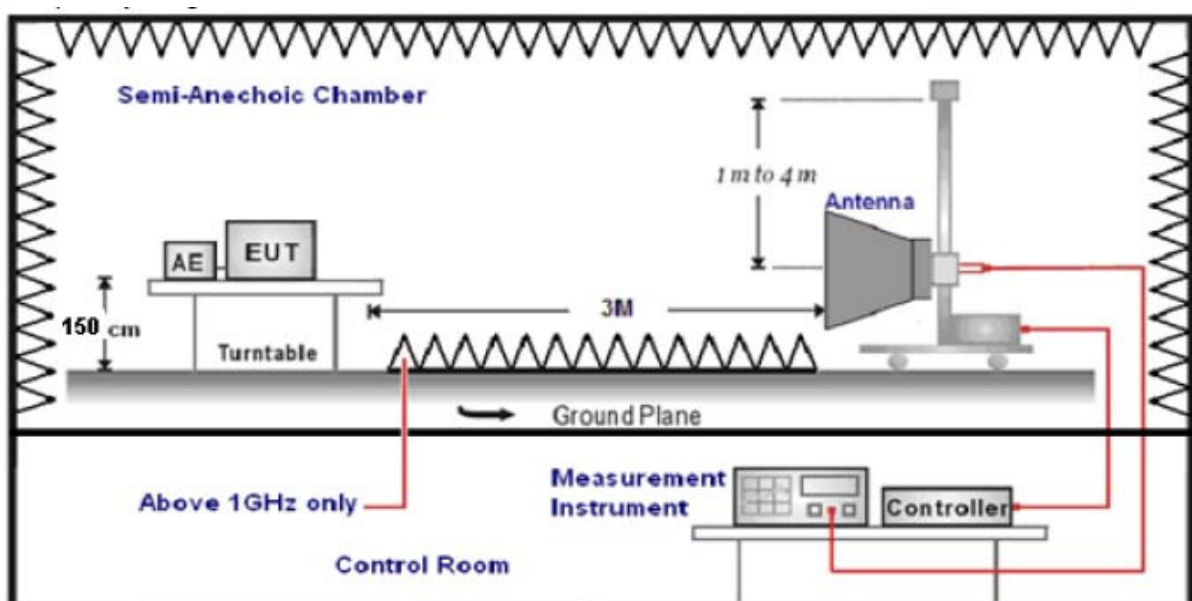
Frequency range 9 KHz – 30MHz



Frequency range 30MHz – 1000MHz



Frequency range above 1GHz-25GHz



TEST PROCEDURE

1. The EUT was placed on a turn table which is 0.8m above ground plane when testing frequency range 9 KHz –1GHz;the EUT was placed on a turn table which is 1.5m above ground plane when testing frequency range 1GHz – 25GHz.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0° to 360° to acquire the highest emissions from EUT.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. The EUT minimum operation frequency was 32.768KHz and maximum operation frequency was 2480MHz.so radiated emission test frequency band from 9KHz to 25GHz.
6. The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
9KHz-30MHz	Active Loop Antenna	3
30MHz-1GHz	Ultra-Broadband Antenna	3
1GHz-18GHz	Double Ridged Horn Antenna	3
18GHz-25GHz	Horn Antenna	1

7. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
9KHz-150KHz	RBW=200Hz/VBW=3KHz,Sweep time=Auto	QP
150KHz-30MHz	RBW=9KHz/VBW=100KHz,Sweep time=Auto	QP
30MHz-1GHz	RBW=120KHz/VBW=1000KHz,Sweep time=Auto	QP
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

$$\text{Transd}=AF +CL-AG$$

RADIATION LIMIT

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission from intentional radiators at a distance of 3 meters shall not exceed the following table. According to § 15.247(d), in any 100kHz bandwidth outside the frequency band in which the EUT is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of desired power.

The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos.

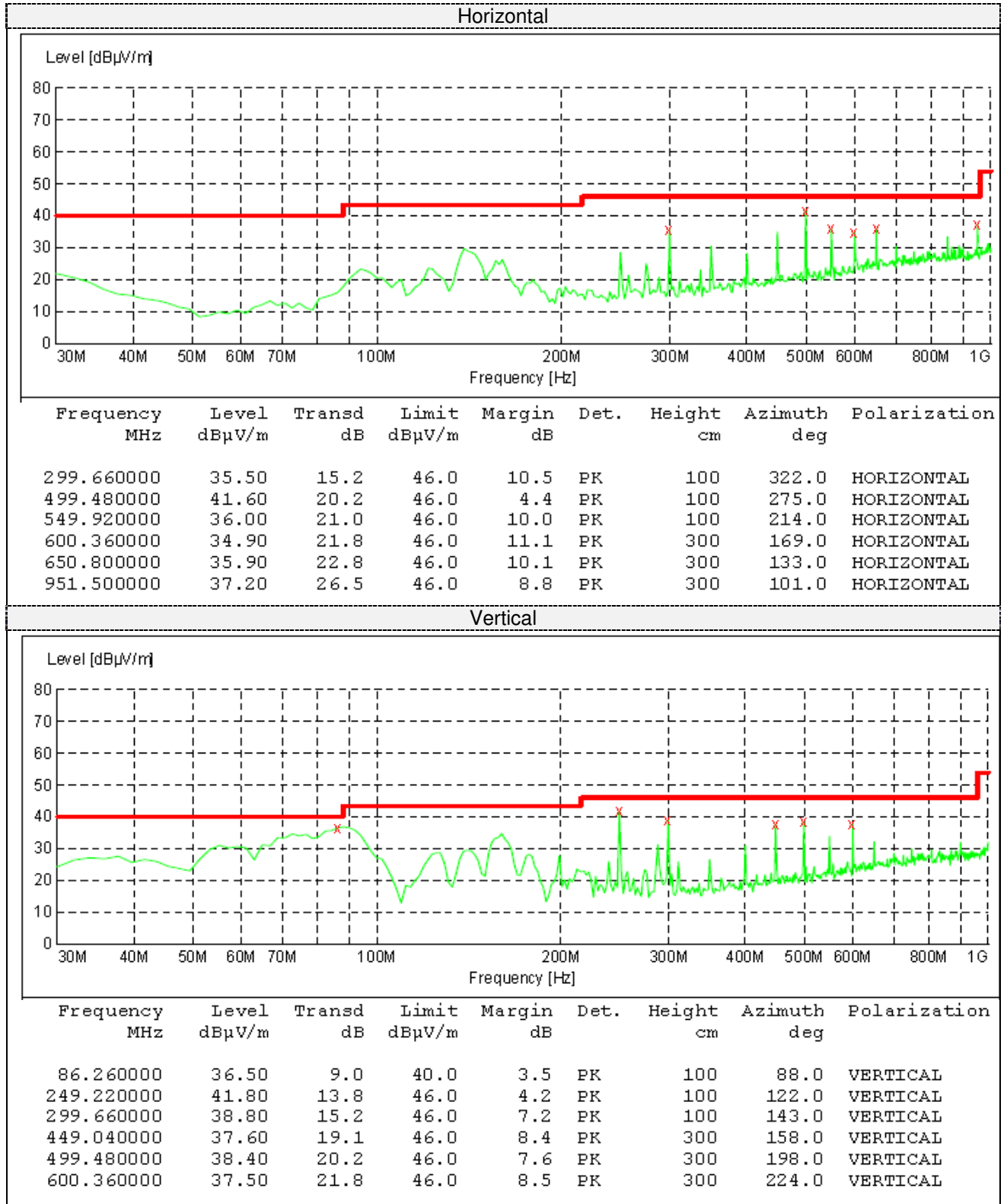
Frequency (MHz)	Distance (Meters)	Radiated (dBµV/m)	Radiated (µV/m)
0.009-0.49	3	$20\log(2400/F(\text{KHz}))+40\log(300/3)$	$2400/F(\text{KHz})$
0.49-1.705	3	$20\log(24000/F(\text{KHz}))+40\log(30/3)$	$24000/F(\text{KHz})$
1.705-30	3	$20\log(30)+40\log(30/3)$	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

TEST RESULTS

Remark: Test site: Shenzhen CTL Testing Technology Co., Ltd.

For 9KHz to 30MHz

Frequency (MHz)	Corrected Reading (dBuV/m)@3m	FCC Limit (dBuV/m) @3m	Margin (dB)	Detector	Result
0.42	50.46	95.14	44.68	QP	PASS
2.48	40.28	69.54	29.26	QP	PASS
19.54	41.36	69.54	28.18	QP	PASS
27.62	41.55	69.54	27.99	QP	PASS

For 30MHz to 1000MHz

For 1GHz to 25GHz

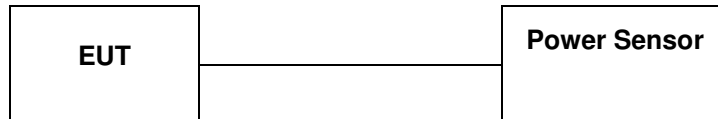
[illegible][illegible][illegible][illegible][illegible][illegible]

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor
3. Margin value = Limit value - Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.

4.3. Maximum Peak Output Power

TEST CONFIGURATION



TEST PROCEDURE

According to KDB558074 D01 DTS Measurement Guidance Section 9.1 Maximum peak conducted output power, 9.1.2.

The maximum peak conducted output power may be measured using a broadband peak RF power meter. 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.

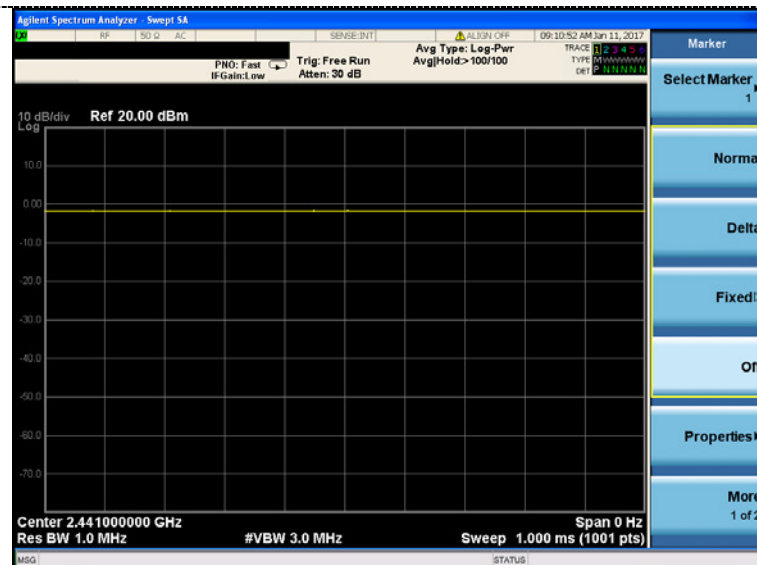
LIMIT

The Maximum Peak Output Power Measurement is 30dBm.

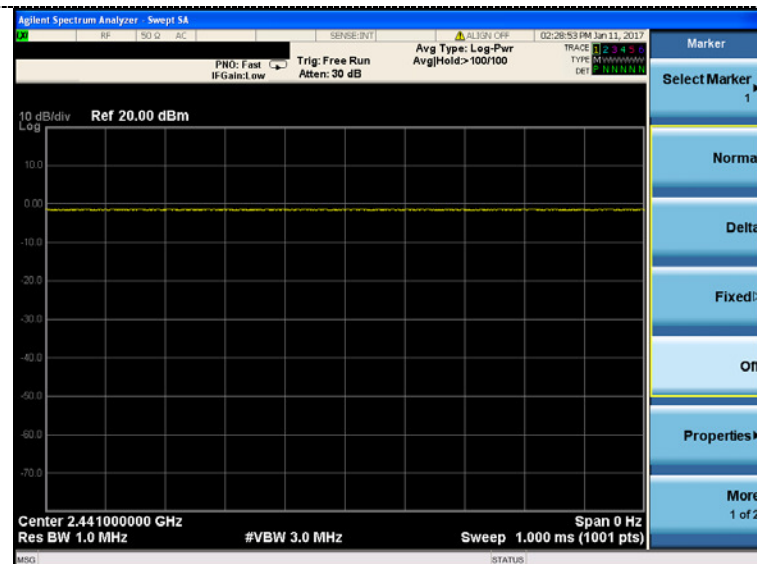
TEST RESULTS

Type	Channel	Peak Output power (dBm)	Average Output power (dBm)	Limit (dBm)	Result
ANT1	0	-2.39	-2.92	30	Pass
	7	-1.67	-2.14		
	15	-1.37	-1.91		
ANT2	0	-0.18	-0.84	30	Pass
	7	-1.17	-1.73		
	15	-0.55	-1.26		
ANT3	0	-3.18	-3.84	30	Pass
	7	-4.88	-5.72		
	15	-3.07	-3.75		

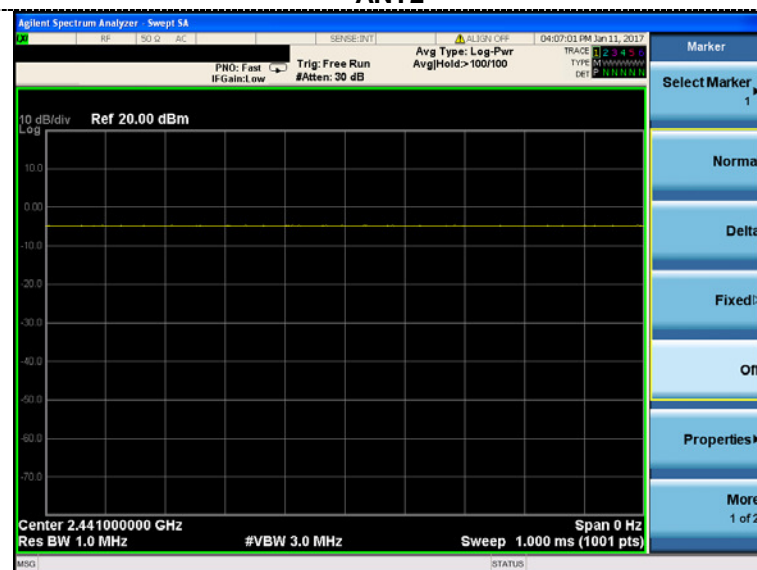
Type	Channel	Peak Output power ANT1 (dBm)	Peak Output power ANT2 (dBm)	Peak Output power ANT3 (dBm)	Output power Total (dBm)	Limit (dBm)	Result
GFSK	0	-2.39	-0.18	-3.18	3.05	30	Pass
	7	-1.67	-1.17	-4.88	2.48		
	15	-1.37	-0.55	-3.07	3.23		



ANT1



ANT2



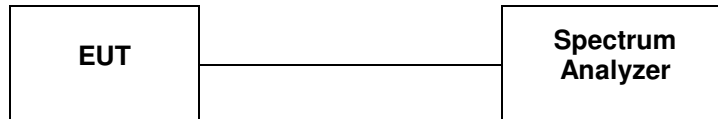
ANT3

Note: The test results including the cable lose.

Duty cycle used in all test items: 100%

4.4. Power Spectral Density

TEST CONFIGURATION



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 = 3 kHz.
3. Set the VBW = 10 kHz.
4. Set the span to 1.5 times the DTS channel 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 power level.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.
11. The resulting peak PSD level must be 8 dBm.

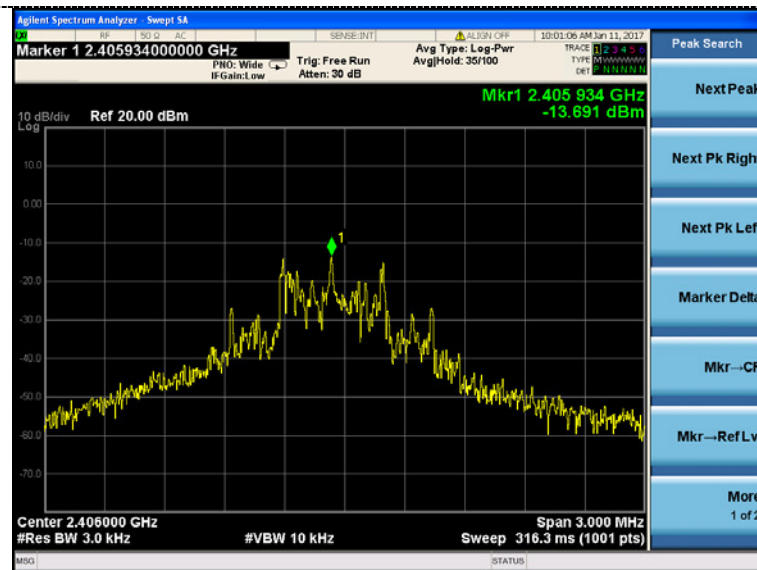
LIMIT

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.

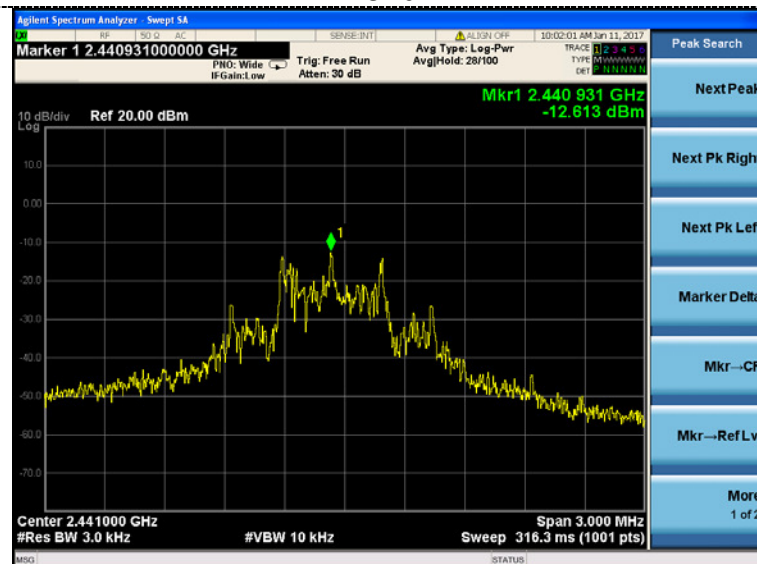
TEST RESULTS

Type	Channel	Power Spectral Density ANT1 (dBm/3KHz)	Power Spectral Density ANT2 (dBm/3KHz)	Power Spectral Density ANT3 (dBm/3KHz)	Power Spectral Density Total (dBm/3KHz)	Limit (dBm/3KHz)	Result
GFSK	0	-13.69	-9.03	-14.70	-6.95	8.00	Pass
	7	-12.61	-12.82	-16.08	-8.80		
	15	-10.74	-11.52	-12.25	-6.69		

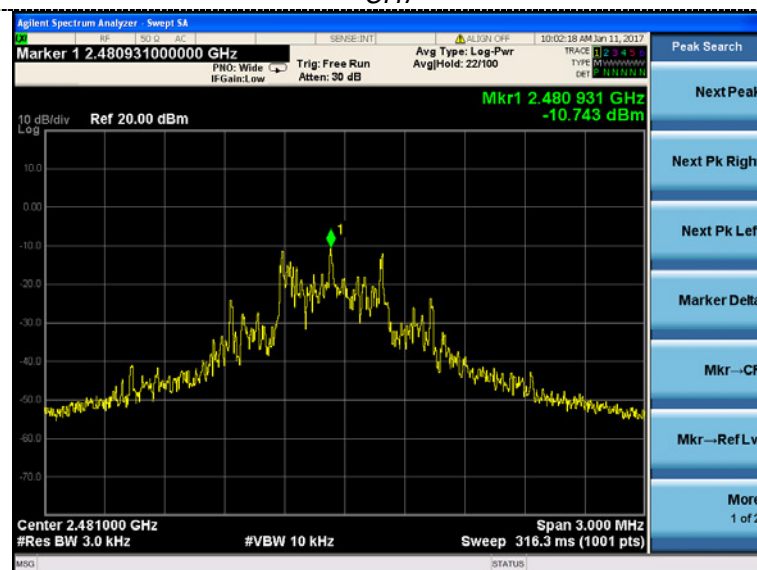
ANT1



CH0

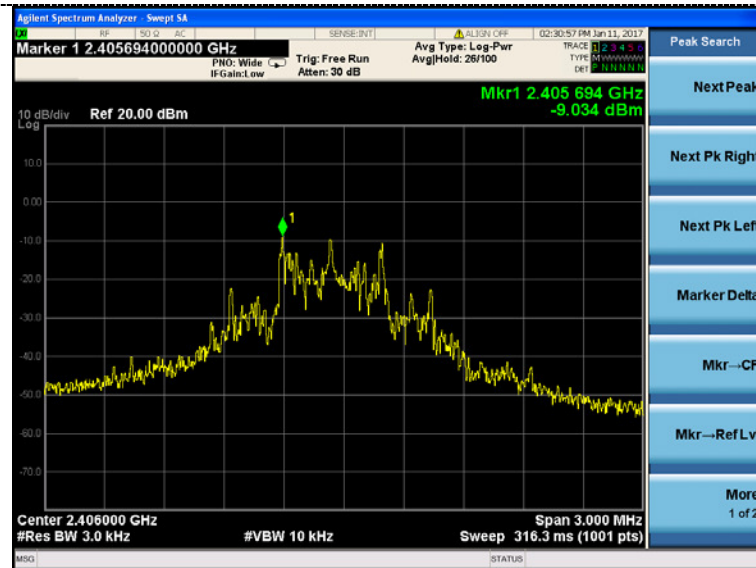


CH7

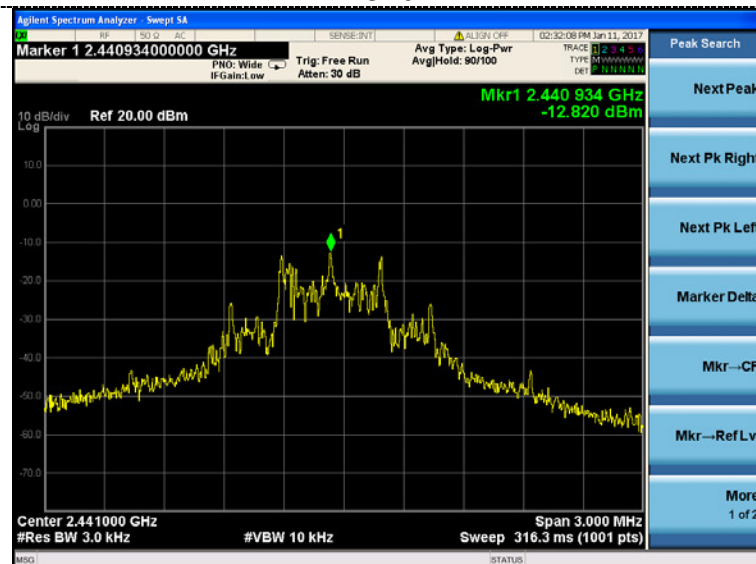


CH15

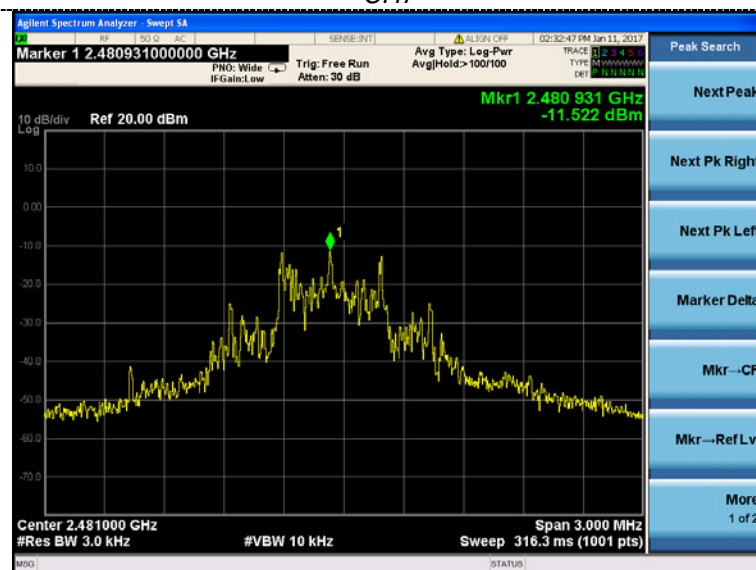
ANT2



CH0

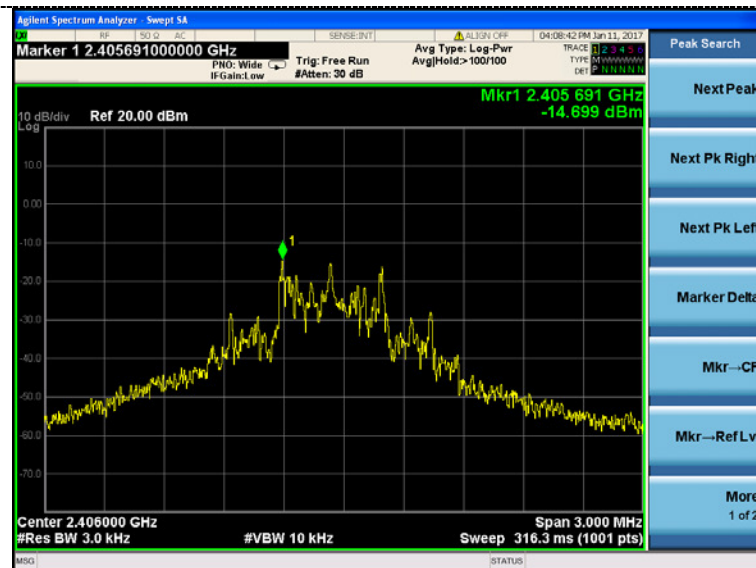


CH7



CH15

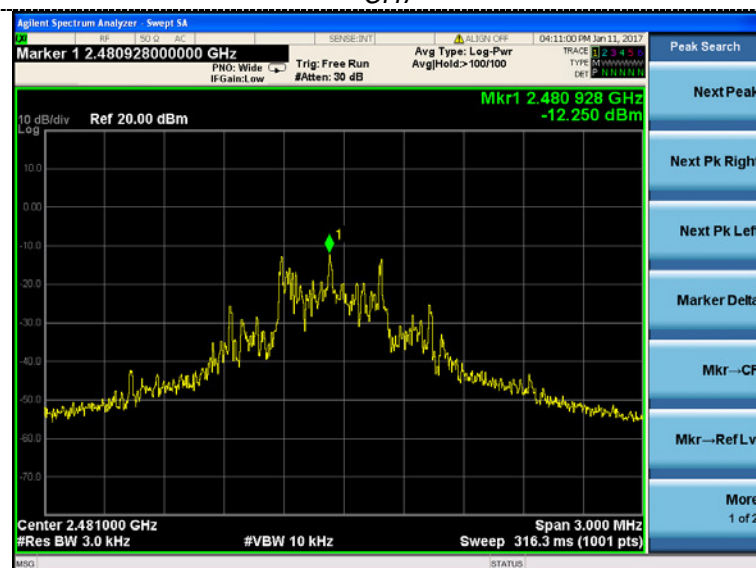
ANT3



CH0



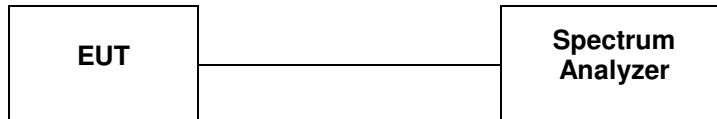
CH7



CH15

4.5. 6dB Bandwidth

TEST CONFIGURATION



TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW=100 KHz and VBW=300KHz. The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB. According to KDB558074 D01 V03 for one of the following procedures may be used to determine the modulated DTS device signal bandwidth.

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. 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.

LIMIT

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

TEST RESULTS

ANT1

Type	Channel	6dB Bandwidth (KHz)	Limit (KHz)	Result
GFSK	0	577.4	≥ 500	Pass
	7	571.6		
	15	565.9		

ANT2

Type	Channel	6dB Bandwidth (KHz)	Limit (KHz)	Result
GFSK	0	572.1	≥ 500	Pass
	7	570.1		
	15	564.1		

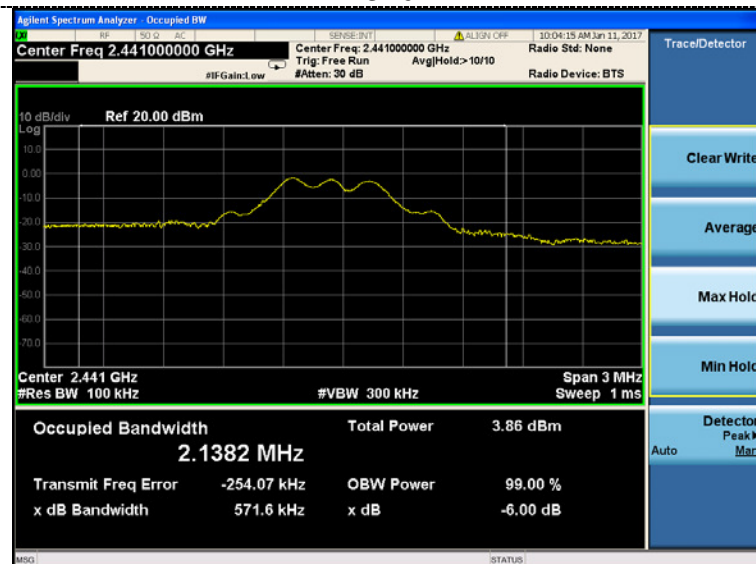
ANT3

Type	Channel	6dB Bandwidth (KHz)	Limit (KHz)	Result
GFSK	0	576.7	≥ 500	Pass
	7	565.1		
	15	567.6		

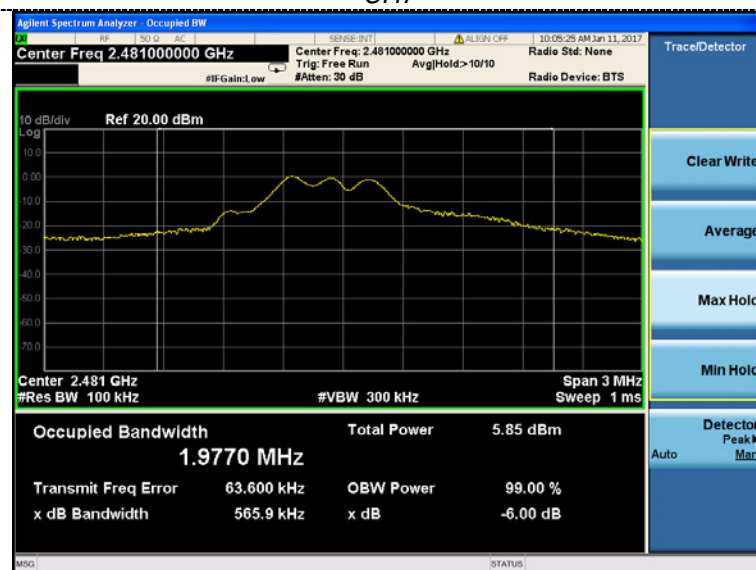
ANT1



CH0

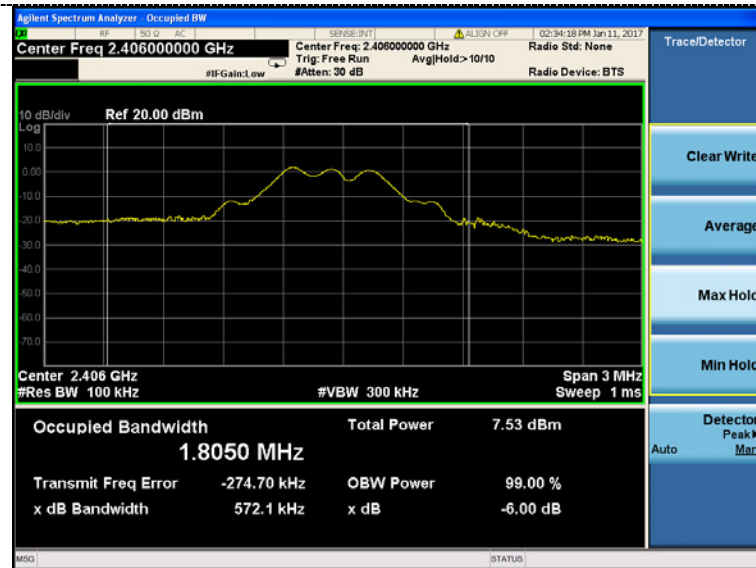


CH7

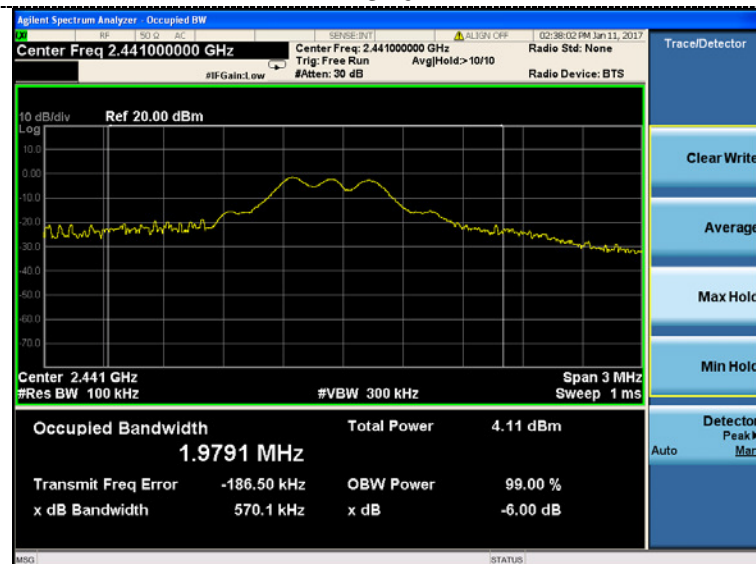


CH15

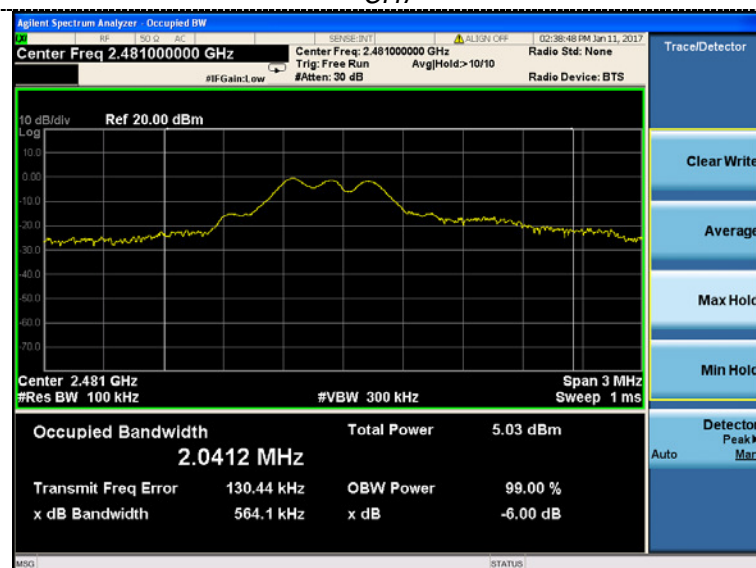
ANT2



CH0

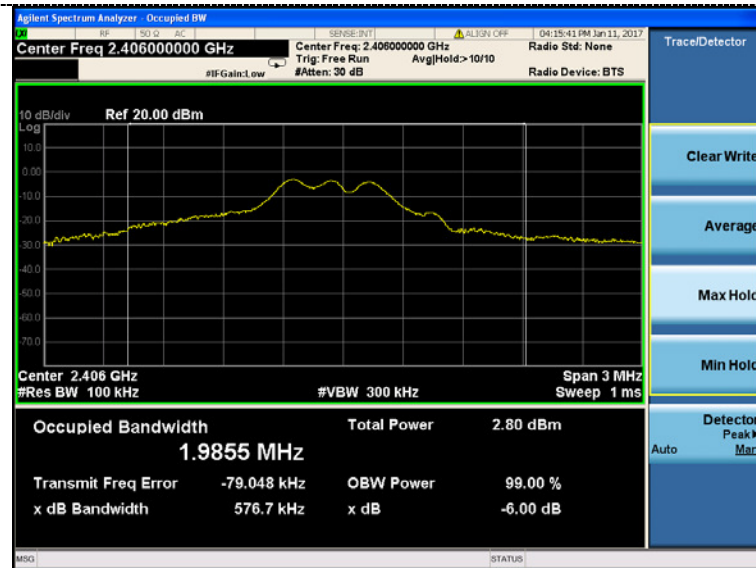


CH7

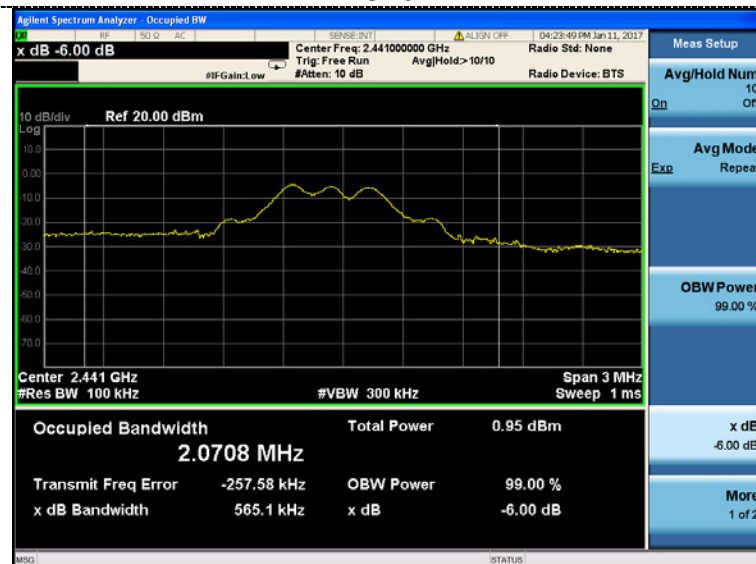


CH15

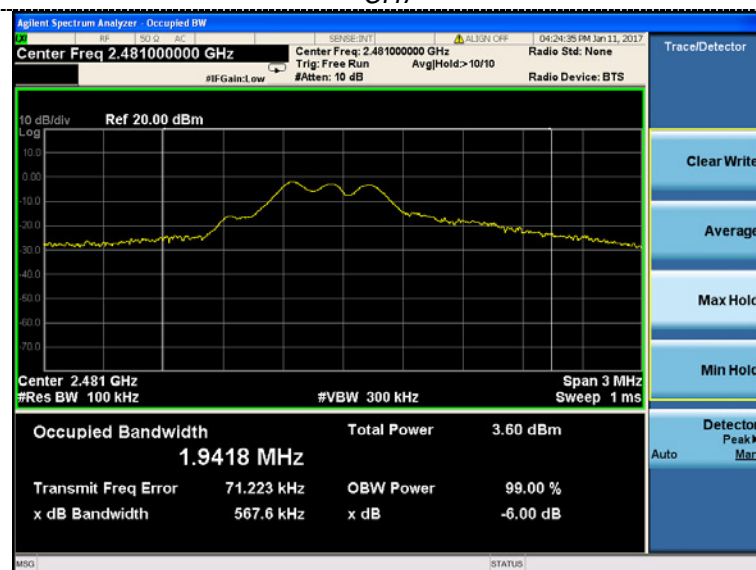
ANT3



CH0



CH7



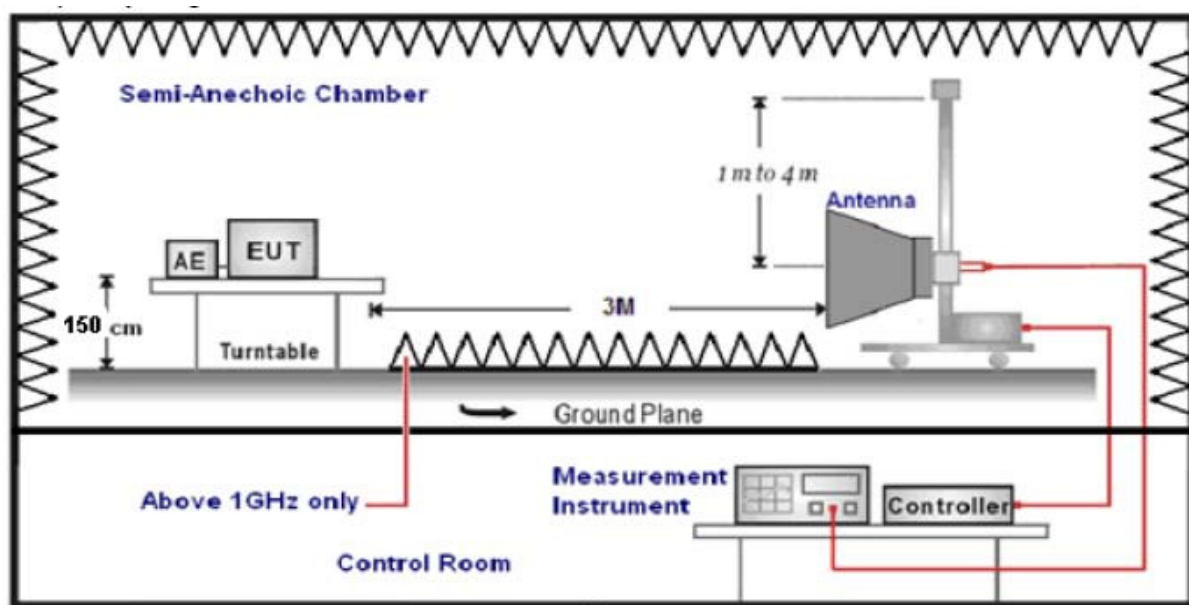
CH15

4.6. Band Edge Compliance of RF Emission

TEST REQUIREMENT

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 CONFIGURATION



TEST PROCEDURE

1. The EUT was placed on a turn table which is 1.5m above ground plane.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0° to 360° to acquire the highest emissions from EUT.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed..
5. The distance between test antenna and EUT was 3 meter:
6. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

LIMIT

Below -20dB of the highest emission level in operating band.

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)

TEST RESULTS

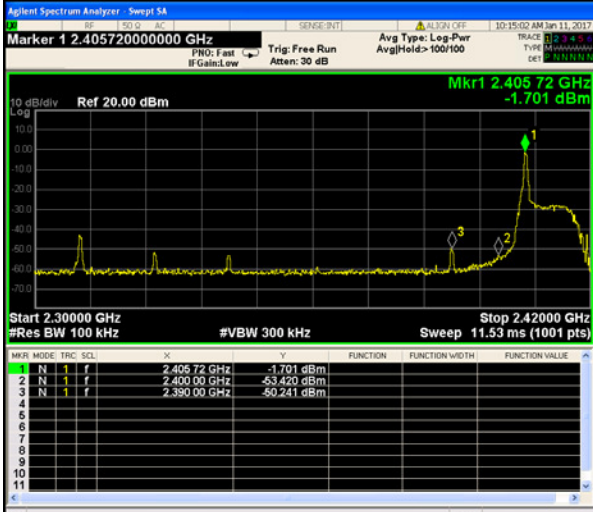
Remark: Test site: Shenzhen CTL Testing Technology Co., Ltd.

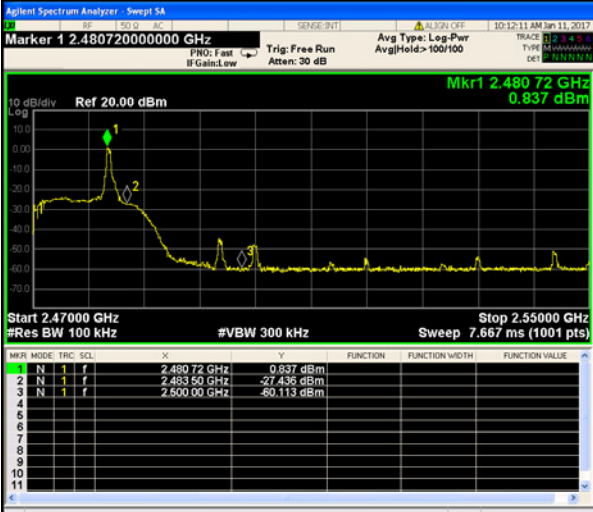
4.6.1 For Radiated Bandedge Measurement

Frequency(MHz):			2406			Polarity:			HORIZONTAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)
2390.00	51.39	PK	74.00	22.61	1.00	147	56.70	27.49	3.32	36.12	-5.31
2390.00	41.27	AV	54.00	12.73	1.00	147	46.58	27.49	3.32	36.12	-5.31
Frequency(MHz):			2406			Polarity:			VERTICAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)
2390.00	50.49	PK	74.00	23.51	1.00	226	55.80	27.49	3.32	36.12	-5.31
2390.00	42.33	AV	54.00	11.67	1.00	226	47.64	27.49	3.32	36.12	-5.31
Frequency(MHz):			2481			Polarity:			HORIZONTAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)
2483.50	49.56	PK	74.00	24.44	1.00	119	55.28	27.45	3.38	36.55	-5.72
2483.50	40.22	AV	54.00	13.78	1.00	119	45.94	27.45	3.38	36.55	-5.72
Frequency(MHz):			2481			Polarity:			VERTICAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)
2483.50	49.67	PK	74.00	24.33	1.00	82	55.39	27.45	3.38	36.55	-5.72
2483.50	39.74	AV	54.00	14.26	1.00	82	45.46	27.45	3.38	36.55	-5.72

4.6.2 For Conducted Bandedge Measurement**ANT1**

Frequency (MHz)	Delta Peak to Band emission (dBc)	Limit (dBc)	Verdict
2400.00	-51.72	-20	PASS
2483.50	-28.27	-20	PASS





2406	2481
------	------

ANT2

Frequency (MHz)	Delta Peak to Band emission (dBc)	Limit (dBc)	Verdict
2400.00	-23.75	-20	PASS
2483.50	-28.31	-20	PASS

Mkr	Mode	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.40571 GHz	2.164 dBm			
2	N	1	f	2.40000 GHz	-21.583 dBm			
3	N	1	f	2.39000 GHz	-44.553 dBm			

2406

Mkr	Mode	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.48072 GHz	0.338 dBm			
2	N	1	f	2.48350 GHz	-27.967 dBm			
3	N	1	f	2.50000 GHz	-58.232 dBm			

2481

ANT3

Frequency (MHz)	Delta Peak to Band emission (dBc)	Limit (dBc)	Verdict
2400.00	-52.61	-20	PASS
2483.50	-28.00	-20	PASS

Mkr	Mode	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.40572 GHz	-3.191 dBm			
2	N	1	f	2.40000 GHz	-55.798 dBm			
3	N	1	f	2.39000 GHz	-50.040 dBm			

2406

Mkr	Mode	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.48072 GHz	-1.578 dBm			
2	N	1	f	2.48350 GHz	-29.575 dBm			
3	N	1	f	2.50000 GHz	-60.871 dBm			

2481