FCC RADIO TEST REPORT-BLE
FCC ID:2AGUJBM5510

Product：	Fingerprint smart terminal
Trade Name：	Aratek
Model Name：	BM5510
Serial Model：	BM5500, BM5520, BM5530, VIU500-ATK100
Report No.：	NTEK-2015NT1126170F2-01

Prepared for

ShenZhen Aratek Biometrics Technology Co.,Ltd.

2F,T2-A Building,ShenZhen Software Park,South Area,Hi-Tech Park,ShenZhen,Guangdong,China

Prepared by

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TEST RESULT

Applicant's name	ShenZhen Aratek Biometrics Technology Co.,Ltd.
Address	2F,T2-A Building,ShenZhen Software Park,South Area,Hi-Tech Park,ShenZhen,Guangdong,China
Manufacture's Name	ShenZhen Aratek Biometrics Technology Co.,Ltd.
Address	2F,T2-A Building,ShenZhen Software Park,South Area,Hi-Tech Park,ShenZhen,Guangdong,China

Product description

Product name	Fingerprint smart terminal
Model and/or type reference	BM5510
Serial Model	BM5500, BM5520, BM5530, VIU500-ATK100
Standards	FCC Part15.247: 01 Oct. 2015
Test procedure	ANSI C63.10-2013 and KDB 558074 D01 V03

This device described above has been tested by NTEK, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Date of Test	:	
Date (s) of performance of tests	:	26 Nov. 2015 ~05 Nov. 2016
Date of Issue	:	05 Nov. 2016
Test Result	:	**Pass**

Testing Engineer	:	Eileen Liu.
		(Eileen Liu)
Technical Manager	:	Jason chen
		(Jason Chen)
Authorized Signatory	:	Sam. Chen
		(Sam Chen)

Revison History

Revision	Issue Date	Revisions	Revised By
00	2016-11-05	Initial Issue	Sam Chen

Contents

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 V03: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

2 SUMMARY

2.1 General Description of EUT

Equipment	Fingerprint smart terminal
Trade Name	Aratek
Model Name	BM5510
Serial Model	BM5500, BM5520, BM5530, VIU500-ATK100
Model Difference	All the model are the same circuit and RF module, except the model name and colour.
Product Description	The EUT is a Fingerprint smart terminal Operation Frequency: 2402~2480MHz Modulation Type: GFSK Number Of Channel 40CH Antenna Designation: Please see Note 3. Antenna Gain (dBi) 1.0dBi Based on the application, features, or specification exhibited in User's Manual, the EUT is considered as an ITE/Computing Device. More details of EUT technical specification, please refer to the User's Manual.
Channel List	Please refer to the Note 2.
Ratings	DC 3.7V
Adapter	Mode:K-E30502000U1 Input: 100-240V~, 50/60Hz, 0.35A Max Output: 5V⎓, 2000mA
Battery	DC 3.7V, 10000mAh
Connecting I/O Port(s)	Please refer to the User's Manual

2.2 Description of the test mode

The application provider specific test software to control sample in continuous TX and RX (Duty Cycle >98%)

For testing meet KDB558074 test requirement.

The EUT has been tested under typical operating condition. The Applicant provides communication tools software to control the EUT for staying in continuous transmitting and receiving mode for testing. There are 40 channels of EUT, and the test carried out at the lowest channel, middle channel and highest channel

Channel	Frequency(MHz)	Channel	Frequency(MHz)
00	**2402**	20	2442
01	2404	21	2444
02	2406	22	2446
03	2408	23	2448
04	2410	24	2450
05	2412	25	2452
06	2414	26	2454
07	2416	27	2456
08	2418	28	2458
09	2420	29	2460
10	2422	30	2462
11	2424	31	2464
12	2426	32	2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
18	2438	38	2478
19	**2440**	**39**	**2480**

2.3 Table of Filed Antenna

Antenna	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	Note
A	N/A	N/A	FPCB Antenna	N/A	1.0	BT Antenna

2.4 Customized Configurations

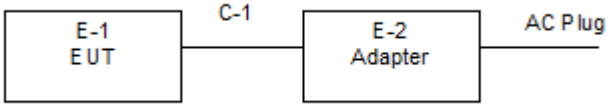
#EUT Conf.	Signal Description	Operating Frequency
TM1_ Ch00	GFSK modulation	Ch No. 00/2402MHz
TM1_ Ch19	GFSK modulation	Ch No. 19/ 2440MHz
TM1_ Ch39	GFSK modulation	Ch No. 39/ 2480MHz
TM1_ Link	GFSK modulation	GFSK Link Mode

For Conducted Emission	
Final Test Mode	Description
TM1_ Link	GFSK Link Mode

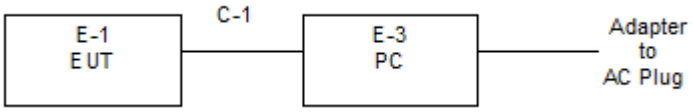
For Radiated Emission	
Final Test Mode	Description
TM1_ Ch00	Ch No. 00/2402MHz
TM1_ Ch19	Ch No. 19/ 2440MHz
TM1_ Ch39	Ch No. 39/ 2480MHz
TM1_ Link	GFSK Link Mode

2.5 Block Diagram Showing the Configuration of Test System

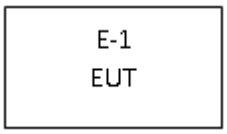
Conducted Emission Test 1



Conducted Emission Test 2



Radiated Emission



2.6 EUT operation mode

The EUT has been tested under typical operating condition. The Applicant provides command

to control the EUT for staying in continuous transmitting (Duty Cycle >98%) and receiving mode for testing.

2.7 Description of Support Units (Conducted Mode)

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Brand	Model/Type No.	Series No.	Note
E-1	Fingerprint smart terminal	Aratek	BM5510	N/A	EUT
E-2	ADAPTER	N/A	BM5510	N/A	
E-3	PC	lenovo	Y43p	N/A	

Item	Shielded Type	Ferrite Core	Length	Note
C-1	NO	NO	1.2m	

Note:
(1) The support equipment was authorized by Declaration of Confirmation.
(2) For detachable type I/O cable should be specified the length in cm in『Length』column.

3 TEST ENVIRONMENT

3.1 TEST FACILITY

NTEK Testing Technology Co., Ltd
1/F, Building E, Fenda Science Park, Sanwei Community, Xixiang Street, Bao'an District, Shenzhen P.R. China.
There is one 3m semi-anechoic chamber and two line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.4, CISPR 22/EN 55022 and CISPR16-4-1 SVSWR requirements.

FCC Registration No.:238937; IC Registration No.:9270A-1
CNAS Registration No.:L5516

3.2 Environmental conditions

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

Temperature: 15-35 ° C

Humidity: 30-60 %

Atmospheric pressure: 950-1050mbar

3.3 Test Description

Test Item	FCC Part No.	Requirements	Verdict
DTS (6 dB) Bandwidth	15.247(a)(2)	≥ 500 kHz.	PASS
Maximum Peak Conducted Output Power	15.247(b)(3)	For directional gain:< 30dBm – (G[dBi] –6 [dB]),peak; Otherwise :< 30dBm, peak.	PASS
Maximum Power Spectral Density Level	15.247(e)	For directional gain :< 8dBm/3 kHz – (G[dBi] –6[dB]), peak. Otherwise :< 8dBm/3 kHz, peak.	PASS
Band Edges Compliance	15.247(d)	< -20dBr/100 kHz if total peak power ≤power limit.	PASS
Unwanted Emissions into Non-Restricted Frequency Bands	15.247(d)	< -20dBr/100 kHz if total peak power ≤power limit.	PASS
Unwanted Emissions into Restricted Frequency Bands (Conducted)	15.247(d) 15.209	< -20dBr/100 kHz if total peak power ≤power limit.	PASS
Unwanted Emissions into Restricted Frequency Bands (Radiated)	15.247(d) 15.209	FCC Part 15.209 field strength limit;	PASS
AC Power Line Conducted Emissions	15.207	FCC Part 15.207 conducted limit;	PASS

Remark:
1. *The measurement uncertainty is not included in the test result.*

3.4 Summary of measurement results

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)(1)	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 Test Conditions

Test Case	Test Conditions	
	Configuration	Description
DTS (6 dB) Bandwidth	Measurement Method	FCC KDB 558074 §8.2 Option 2
	Test Environment	NTNV
	EUT Configuration	TM1_ Ch0, TM1_ Ch19, TM1_ Ch39
Maximum Peak Conducted Output Power	Measurement Method	FCC KDB 558074§9.1.2
	Test Environment	NTNV
	EUT Configuration	TM1_ Ch0, TM1_ Ch19, TM1_ Ch39
Maximum Power Spectral Density Level	Measurement Method	FCC KDB 558074 §10.2 (peak PSD).
	Test Environment	NTNV
	EUT Configuration	TM1_ Ch0, TM1_ Ch19, TM1_ Ch39
Unwanted Emissions into Non-Restricted Frequency Bands	Measurement Method	FCC KDB 558074§11.0
	Test Environment	NTNV
	EUT Configuration	T TM1_ Ch0, TM1_ Ch19, TM1_ Ch39
Unwanted Emissions into Restricted Frequency Bands (Conducted)	Measurement Method	FCC KDB 558074§12.2, Conducted (antenna-port).
	Test Environment	NTNV
	EUT Configuration	TM1_ Ch0, TM1_ Ch19, TM1_ Ch39

Unwanted Emissions into Restricted	Measurement Method	FCC KDB 558074§12.1,Radiated(cabinet/case emissions with Impedance matching for antenna-port).
	EUT Configuration	TM1_ Ch0, TM1_ Ch19, TM1_ Ch39

Test Case	Test Conditions	
	Configuration	Description
AC Power Line Conducted Emissions	Measurement Method	AC mains conducted.
	Test Environment	NTNV
	EUT Configuration	TM1_ Link

Remark:
1. *For AC Main conducted emission measured at both AC power adapter and charge from PC, recorded worst case in test report.*
2. *For AC Main conducted emission measured at both AC 120V/60Hz and AC 240V/50Hz, recorded worst case in test report.*

3. *For Radiated Emissions, By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that "Z axis" position was the worst, then the final test was executed the worst condition and test data were recorded in this report.*

3.6 Measurement Uncertainty

The reported uncertainty of measurement **y** ± **U**，where expended uncertainty **U** is based on a standard uncertainty multiplied by a coverage factor of **k=2**，providing a level of confidence of approximately **95** %。

No.	Item	Uncertainty
1	Conducted Emission Test	±1.38dB
2	RF power,conducted	±0.16dB
3	Spurious emissions,conducted	±0.21dB
4	All emissions,radiated(<1G)	±4.68dB
5	All emissions,radiated(>1G)	±4.89dB
6	Temperature	±0.5°C
7	Humidity	±2%

3.7 Equipment Used during the Test

Radiation Test equipment

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	Spectrum Analyzer	Agilent	E4407B	MY45108040	2016/07/02	2017/07/01	1 year
2	Test Receiver	R&S	ESPI	101318	2016/07/02	2017/07/01	1 year
3	Bilog Antenna	TESEQ	CBL6111D	31216	2016/07/02	2017/07/01	1 year
4	50Ω Coaxial Switch	Anritsu	MP59B	6200264416	2016/07/02	2017/07/01	1 year
5	Spectrum Analyzer	ADVANTEST	R3132	150900201	2016/07/02	2017/07/01	1 year
6	Horn Antenna	EM	EM-AH-10180	2011071402	2016/07/02	2017/07/01	1 year
7	Horn Ant	Schwarzbeck	BBHA 9170	9170-181	2016/07/02	2017/07/01	1 year
8	Amplifier	EM	EM-30180	060538	2015/12/18	2016/12/17	1 year
9	Loop Antenna	ARA	PLA-1030/B	1029	2016/07/02	2017/07/01	1 year
10	Power Meter	R&S	NRVS	100696	2016/07/02	2017/07/01	1 year
11	Power Sensor	R&S	URV5-Z4	0395.1619.05	2016/07/02	2017/07/01	1 year
12	EMC Test Software	FALA	EZ	N/A	N/A	N/A	N/A

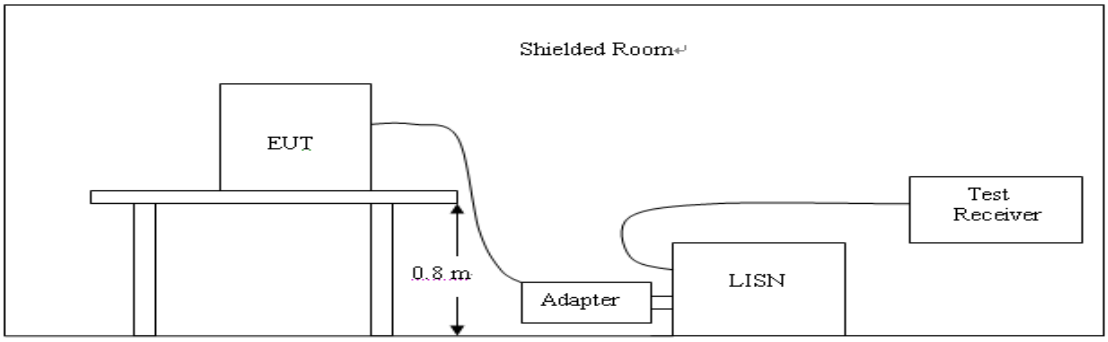
Conduction Test equipment

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	Test Receiver	R&S	ESCI	101160	2016/07/02	2017/07/01	1 year
2	LISN	R&S	ENV216	101313	2016/07/02	2017/07/01	1 year
3	LISN	EMCO	3816/2	00042990	2016/07/02	2017/07/01	1 year
4	50Ω Coaxial Switch	Anritsu	MP59B	6200264417	2016/07/02	2017/07/01	1 year
5	Passive Voltage Probe	R&S	ESH2-Z3	100196	2016/07/02	2017/07/01	1 year
6	Absorbing clamp	R&S	MOS-21	100423	2016/07/02	2017/07/01	1 year
7	EMC Test Software	FALA	EZ	N/A	N/A	N/A	N/A

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 DC5V power from the adapter, 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.
9. The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

AC Power Conducted Emission Limit

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

Frequency (MHz)	Maximum RF Line Voltage (dBμV)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15 - 0.50	79	66	66-56*	56-46*
0.50 - 5.00	73	60	56	46
5.00 - 30.0	73	60	60	50

* Decreasing linearly with the logarithm of the frequency

TEST RESULTS

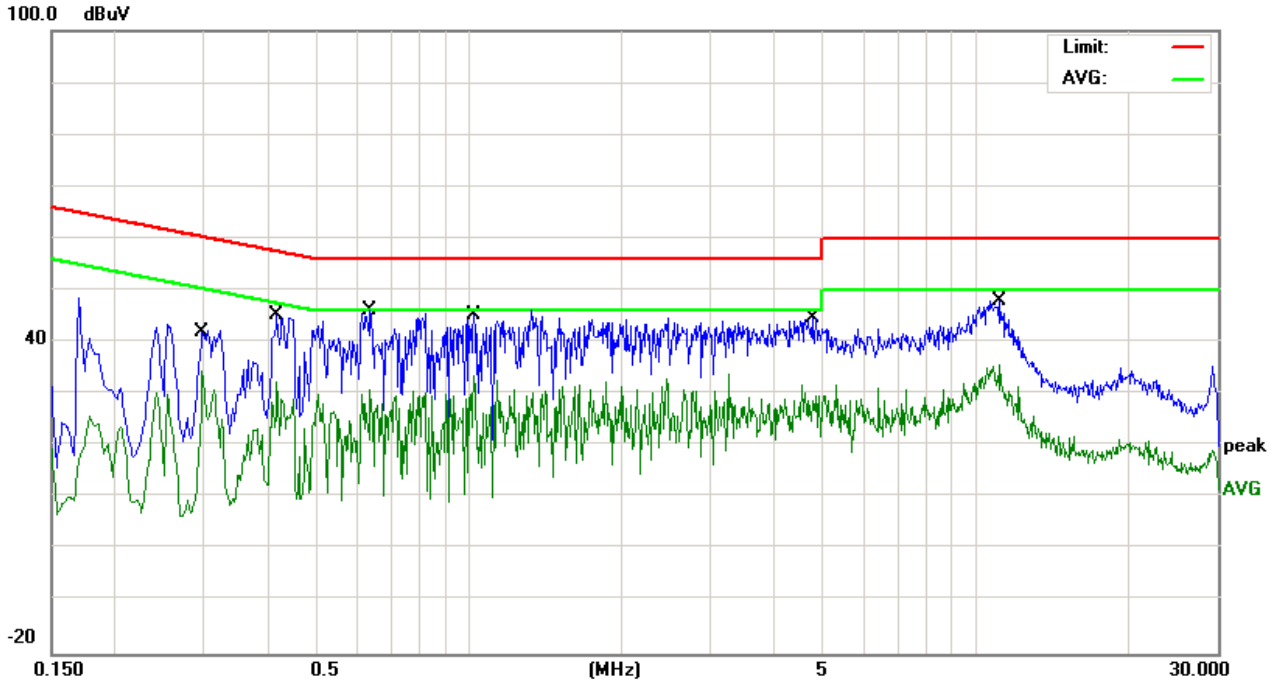
Remark:
1. The AC Power Conducted Emission measurement is performed at both TX and RX (Idle) mode, recorded worst case at TX mode.

2. Measured at power adapter charge and USB charge also at both AC 120V/60Hz and AC 240V/50Hz, recorded worst case.

EUT:	Fingerprint smart terminal	Model Name. :	BM5510
Temperature:	26 ℃	Relative Humidity:	56%
Pressure:	1010hPa	Phase :	L
Test Voltage:	DC 5.0V form Adapter AC 120V/60Hz	Test Mode:	TM1_ Link

Frequency (MHz)	Reading Level (dBμV)	Correct Factor (dB)	Measurement (dBμV)	Limits (dBμV)	Margin (dB)	Remark
0.2979	32.91	9.44	42.35	60.30	-17.95	QP
0.2979	24.91	9.44	34.35	50.30	-15.95	AVG
0.4179	35.73	9.44	45.17	57.49	-12.32	QP
0.4179	22.93	9.44	32.37	47.49	-15.12	AVG
0.6380	36.70	9.44	46.14	56.00	-9.86	QP
0.6380	21.37	9.44	30.81	46.00	-15.19	AVG
1.0220	35.86	9.44	45.30	56.00	-10.70	QP
1.0220	24.01	9.44	33.45	46.00	-12.55	AVG
4.7499	35.27	9.48	44.75	56.00	-11.25	QP
4.7499	22.41	9.48	31.89	46.00	-14.11	AVG
11.1499	38.39	9.70	48.09	60.00	-11.91	QP
11.1499	26.08	9.70	35.78	50.00	-14.22	AVG

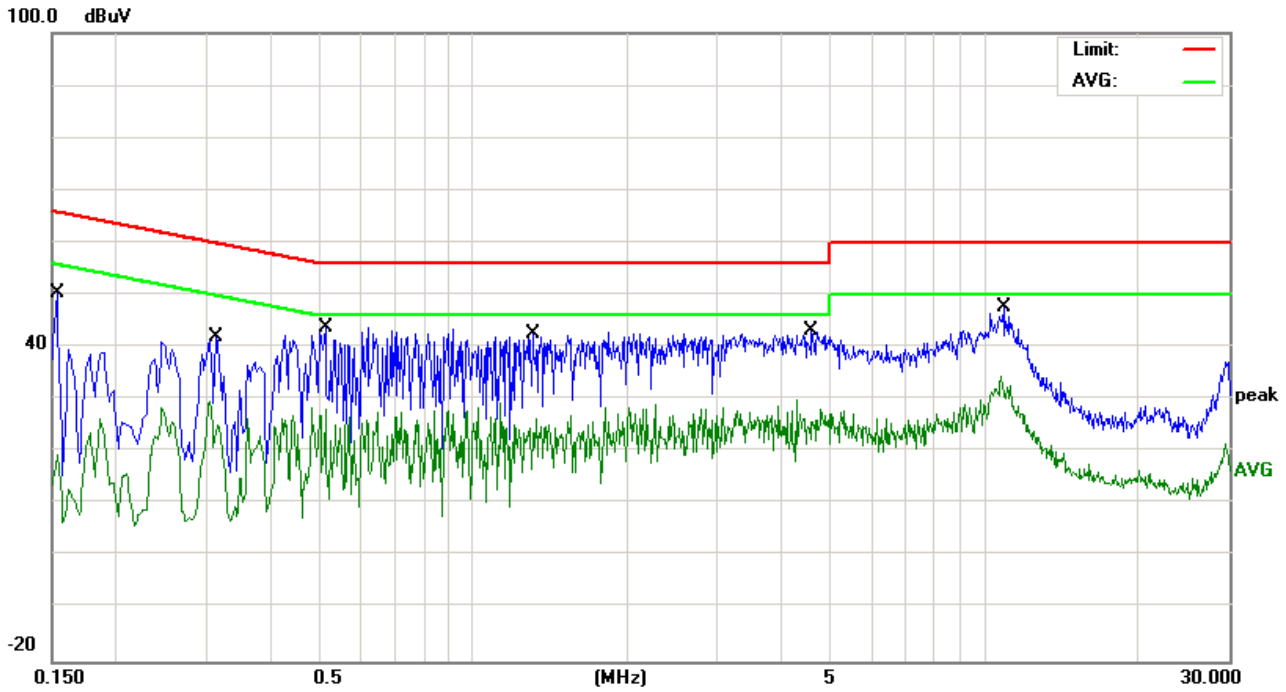
Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.



EUT：	Fingerprint smart terminal	Model Name. ：	BM5510
Temperature：	26 ℃	Relative Humidity：	56%
Pressure：	1010hPa	Phase :	N
Test Voltage ：	DC 5.0V form Adapter AC 120V/60Hz	Test Mode：	TM1_ Link

Frequency (MHz)	Reading Level (dBμV)	Correct Factor (dB)	Measurement (dBμV)	Limits (dBμV)	Margin (dB)	Remark
0.1539	40.98	9.46	50.44	65.78	-15.34	QP
0.1539	16.94	9.46	26.40	55.78	-29.38	AVG
0.3140	32.41	9.44	41.85	59.86	-18.01	QP
0.3140	20.22	9.44	29.66	49.86	-20.20	AVG
0.5140	34.27	9.46	43.73	56.00	-12.27	QP
0.5140	18.87	9.46	28.33	46.00	-17.67	AVG
1.3060	32.96	9.45	42.41	56.00	-13.59	QP
1.3060	20.02	9.45	29.47	46.00	-16.53	AVG
4.5777	33.63	9.48	43.11	56.00	-12.89	QP
4.5777	20.39	9.48	29.87	46.00	-16.13	AVG
10.8819	37.84	9.69	47.53	60.00	-12.47	QP
10.8819	24.65	9.69	34.34	50.00	-15.66	AVG

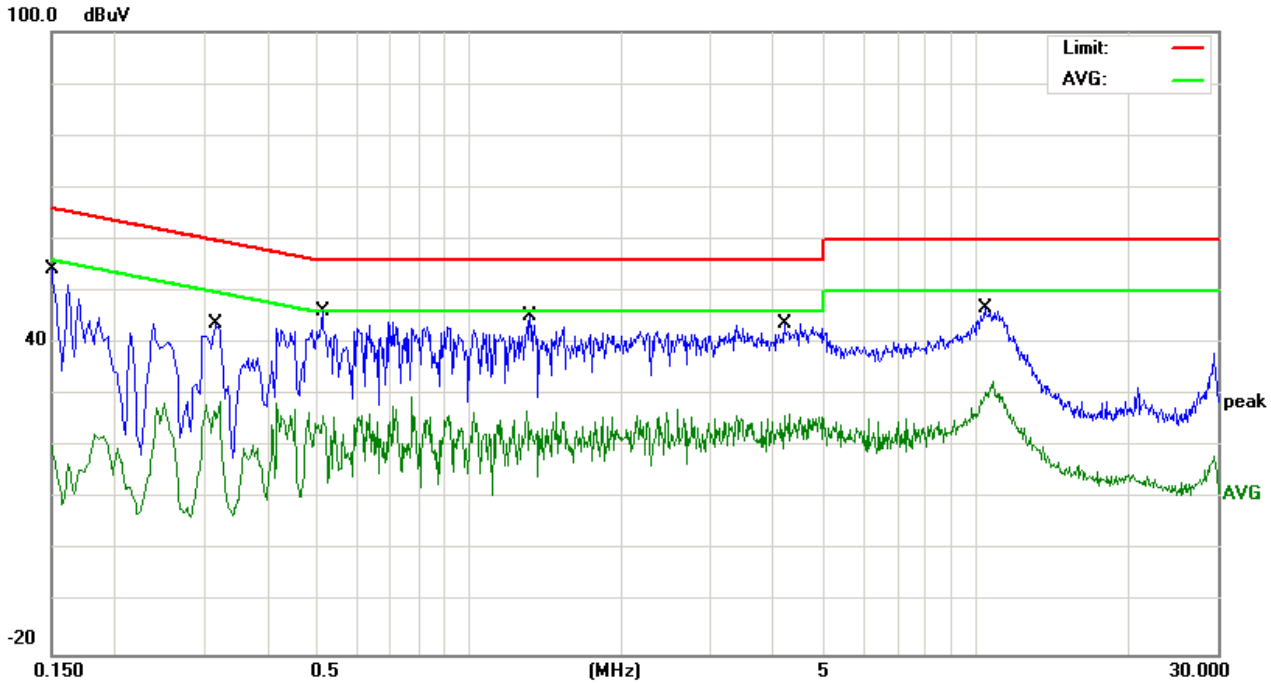
Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.



EUT：	Fingerprint smart terminal	Model Name. ：	BM5510
Temperature：	26 ℃	Relative Humidity：	56%
Pressure：	1010hPa	Phase :	N
Test Voltage ：	DC 5.0V form PC AC 120V/60Hz	Test Mode：	TM1_ Link

Frequency (MHz)	Reading Level (dBμV)	Correct Factor (dB)	Measurement (dBμV)	Limits (dBμV)	Margin (dB)	Remark
0.1500	44.64	9.49	54.13	65.99	-11.86	QP
0.1500	12.82	9.49	22.31	55.99	-33.68	AVG
0.3180	34.18	9.50	43.68	59.76	-16.08	QP
0.3180	19.22	9.50	28.72	49.76	-21.04	AVG
0.5140	36.51	9.55	46.06	56.00	-9.94	QP
0.5140	16.97	9.55	26.52	46.00	-19.48	AVG
1.3220	35.58	9.57	45.15	56.00	-10.85	QP
1.3220	17.43	9.57	27.00	46.00	-19.00	AVG
4.1939	34.14	9.66	43.80	56.00	-12.20	QP
4.1939	16.79	9.66	26.45	46.00	-19.55	AVG
10.4419	36.91	9.75	46.66	60.00	-13.34	QP
10.4419	22.95	9.75	32.70	50.00	-17.30	AVG

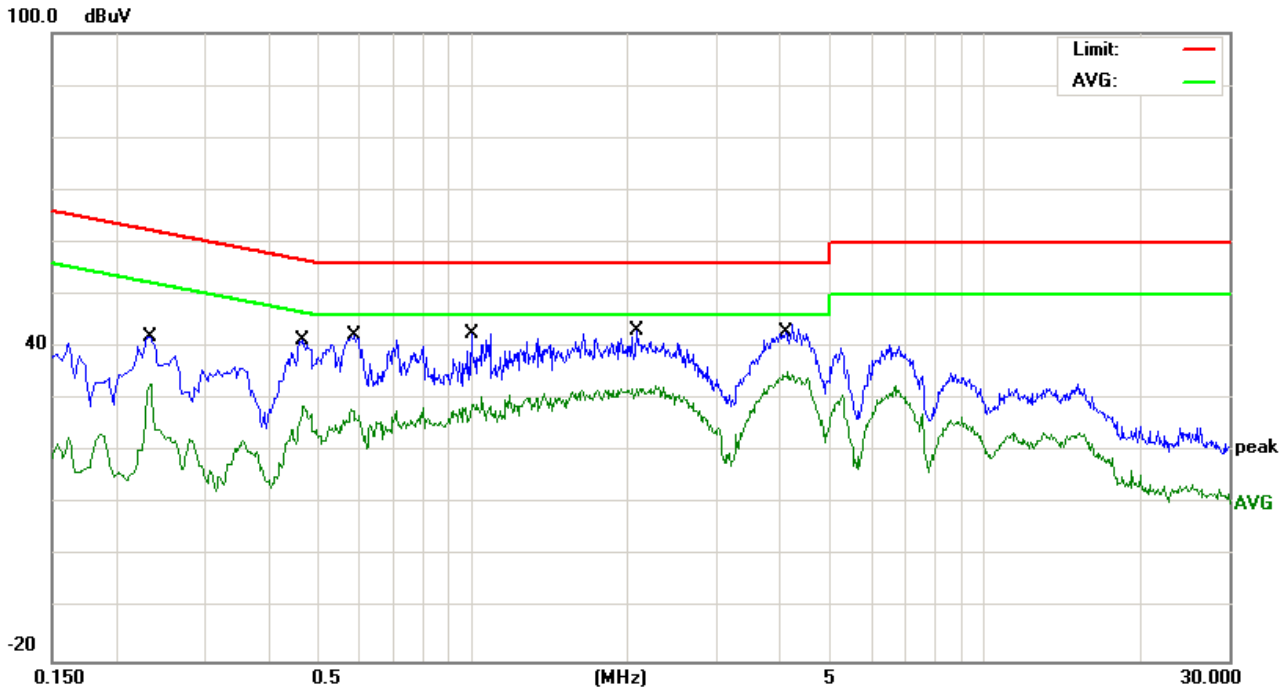
Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.



EUT：	Fingerprint smart terminal	Model Name. ：	BM5510
Temperature：	26 ℃	Relative Humidity：	56%
Pressure：	1010hPa	Phase :	L
Test Voltage ：	DC 5.0V form PC AC 120V/60Hz	Test Mode：	TM1_ Link

Frequency (MHz)	Reading Level (dBμV)	Correct Factor (dB)	Measurement (dBμV)	Limits (dBμV)	Margin (dB)	Remark
0.234	32.58	9.45	42.03	62.30	-20.27	QP
0.234	23.61	9.45	33.06	52.30	-19.24	AVG
0.466	32.03	9.45	41.48	56.58	-15.10	QP
0.466	19.21	9.45	28.66	46.58	-17.92	AVG
0.5859	32.84	9.45	42.29	56.00	-13.71	QP
0.5859	18.69	9.45	28.14	46.00	-17.86	AVG
0.994	33.07	9.44	42.51	56.00	-13.49	QP
0.994	21.00	9.44	30.44	46.00	-15.56	AVG
2.0899	33.64	9.46	43.10	56.00	-12.90	QP
2.0899	23.33	9.46	32.79	46.00	-13.21	AVG
4.1219	34.76	9.47	44.23	56.00	-11.77	QP
4.1219	25.80	9.47	35.27	46.00	-10.73	AVG

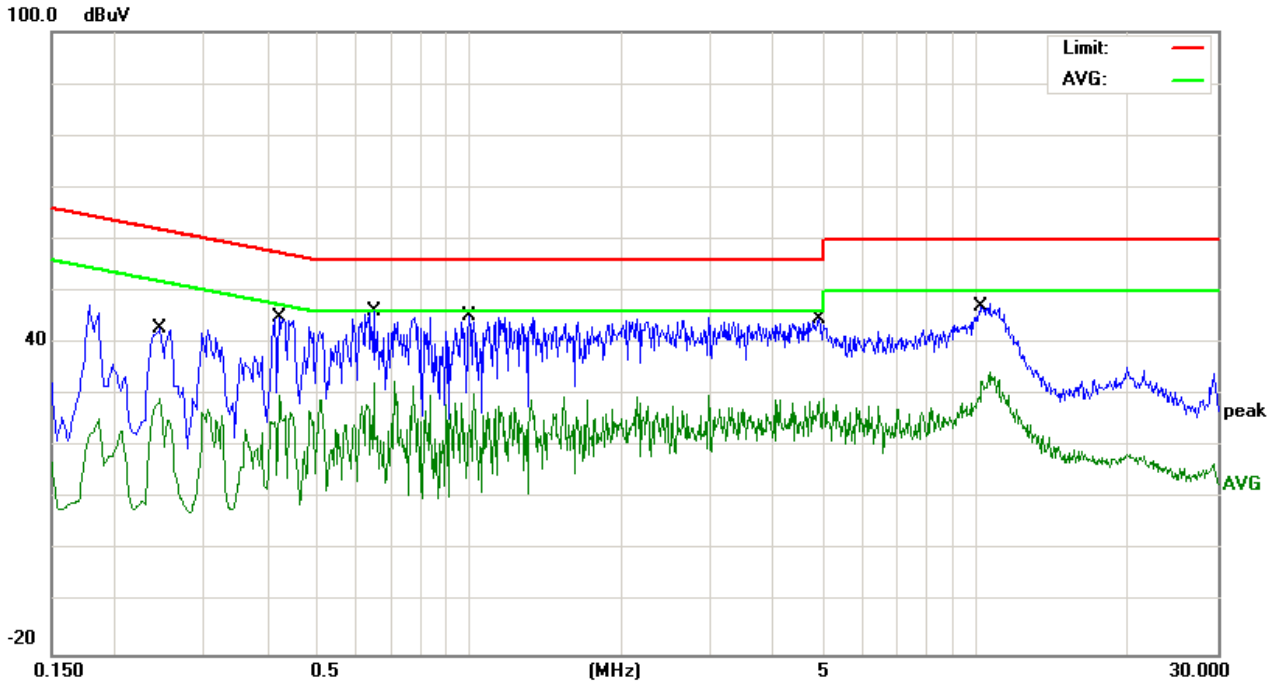
Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.



EUT：	Fingerprint smart terminal	Model Name. ：	BM5510
Temperature：	26 ℃	Relative Humidity：	56%
Pressure：	1010hPa	Phase :	L
Test Voltage ：	DC 5.0V form Adapter AC 240V/60Hz	Test Mode：	TM1_ Link

Frequency (MHz)	Reading Level (dBμV)	Correct Factor (dB)	Measurement (dBμV)	Limits (dBμV)	Margin (dB)	Remark
0.2459	33.32	9.50	42.82	61.89	-19.07	QP
0.2459	19.95	9.50	29.45	51.89	-22.44	AVG
0.4219	35.62	9.25	44.87	57.41	-12.54	QP
0.4219	20.57	9.25	29.82	47.41	-17.59	AVG
0.6500	36.55	9.57	46.12	56.00	-9.88	QP
0.6500	22.76	9.57	32.33	46.00	-13.67	AVG
1.0020	35.60	9.56	45.16	56.00	-10.84	QP
1.0020	20.60	9.56	30.16	46.00	-15.84	AVG
4.9019	34.88	9.68	44.56	56.00	-11.44	QP
4.9019	19.68	9.68	29.36	46.00	-16.64	AVG
10.1659	36.45	9.74	46.19	60.00	-13.81	QP
10.1659	24.65	9.74	34.39	50.00	-15.61	AVG

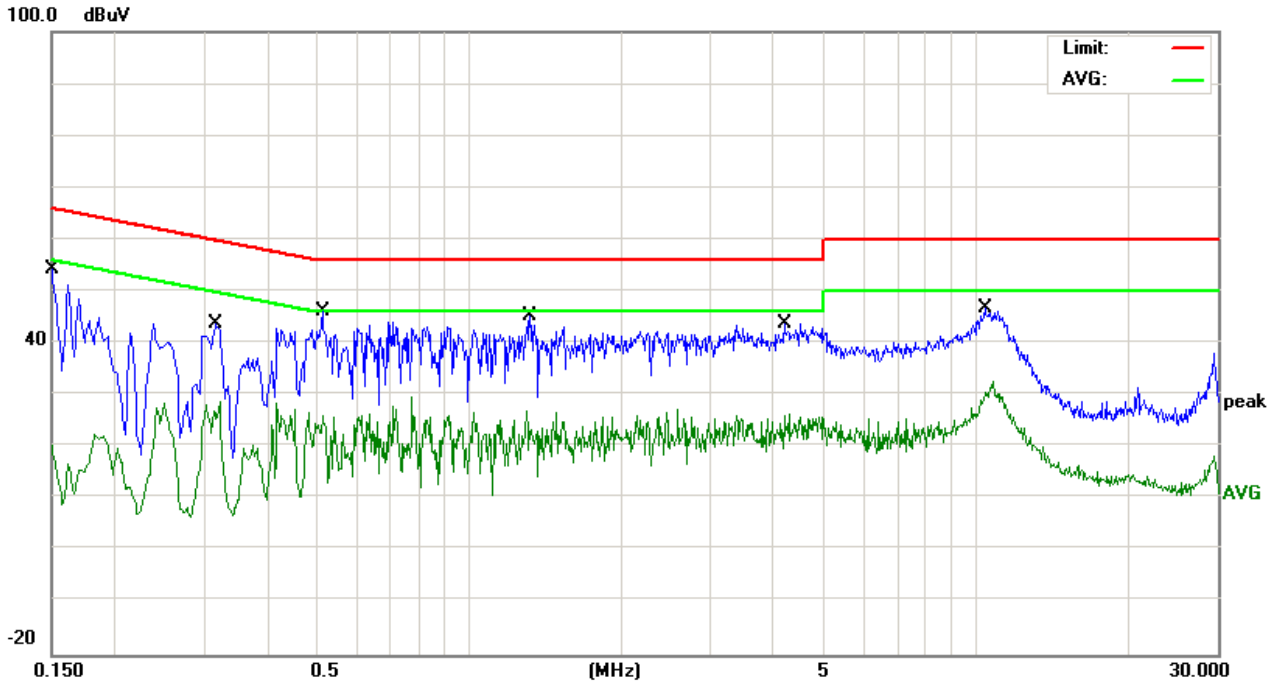
Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.



EUT：	Fingerprint smart terminal	Model Name. ：	BM5510
Temperature：	26 ℃	Relative Humidity：	56%
Pressure：	1010hPa	Phase :	N
Test Voltage ：	DC 5.0V form Adapter AC 240V/60Hz	Test Mode：	TM1_ Link

Frequency (MHz)	Reading Level (dBμV)	Correct Factor (dB)	Measurement (dBμV)	Limits (dBμV)	Margin (dB)	Remark
0.1500	44.64	9.49	54.13	65.99	-11.86	QP
0.1500	12.82	9.49	22.31	55.99	-33.68	AVG
0.3180	34.18	9.50	43.68	59.76	-16.08	QP
0.3180	19.22	9.50	28.72	49.76	-21.04	AVG
0.5140	36.51	9.55	46.06	56.00	-9.94	QP
0.5140	16.97	9.55	26.52	46.00	-19.48	AVG
1.3220	35.58	9.57	45.15	56.00	-10.85	QP
1.3220	17.43	9.57	27.00	46.00	-19.00	AVG
4.1939	34.14	9.66	43.80	56.00	-12.20	QP
4.1939	16.79	9.66	26.45	46.00	-19.55	AVG
10.4419	36.91	9.75	46.66	60.00	-13.34	QP
10.4419	22.95	9.75	32.70	50.00	-17.30	AVG

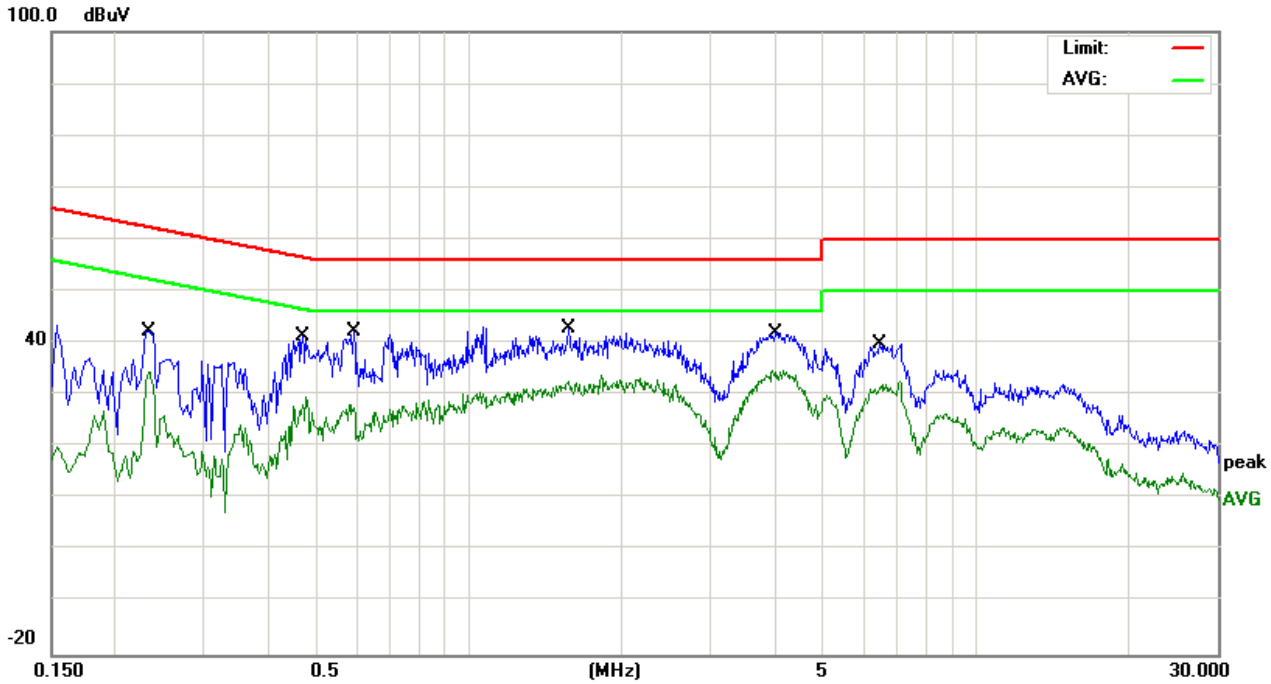
Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.



EUT：	Fingerprint smart terminal	Model Name. ：	BM5510
Temperature：	26 ℃	Relative Humidity：	56%
Pressure：	1010hPa	Phase :	L
Test Voltage ：	DC 5.0V form PC AC 240V/60Hz	Test Mode：	TM1_ Link

Frequency (MHz)	Reading Level (dBμV)	Correct Factor (dB)	Measurement (dBμV)	Limits (dBμV)	Margin (dB)	Remark
0.2340	32.80	9.45	42.25	62.30	-20.05	QP
0.2340	25.10	9.45	34.55	52.30	-17.75	AVG
0.4698	31.94	9.45	41.39	56.52	-15.13	QP
0.4698	20.06	9.45	29.51	46.52	-17.01	AVG
0.5940	32.82	9.45	42.27	56.00	-13.73	QP
0.5940	18.71	9.45	28.16	46.00	-17.84	AVG
1.5700	33.35	9.45	42.80	56.00	-13.20	QP
1.5700	23.21	9.45	32.66	46.00	-13.34	AVG
3.9780	32.92	9.47	42.39	56.00	-13.61	QP
3.9780	25.31	9.47	34.78	46.00	-11.22	AVG
6.4818	30.41	9.50	39.91	60.00	-20.09	QP
6.4818	23.05	9.50	32.55	50.00	-17.45	AVG

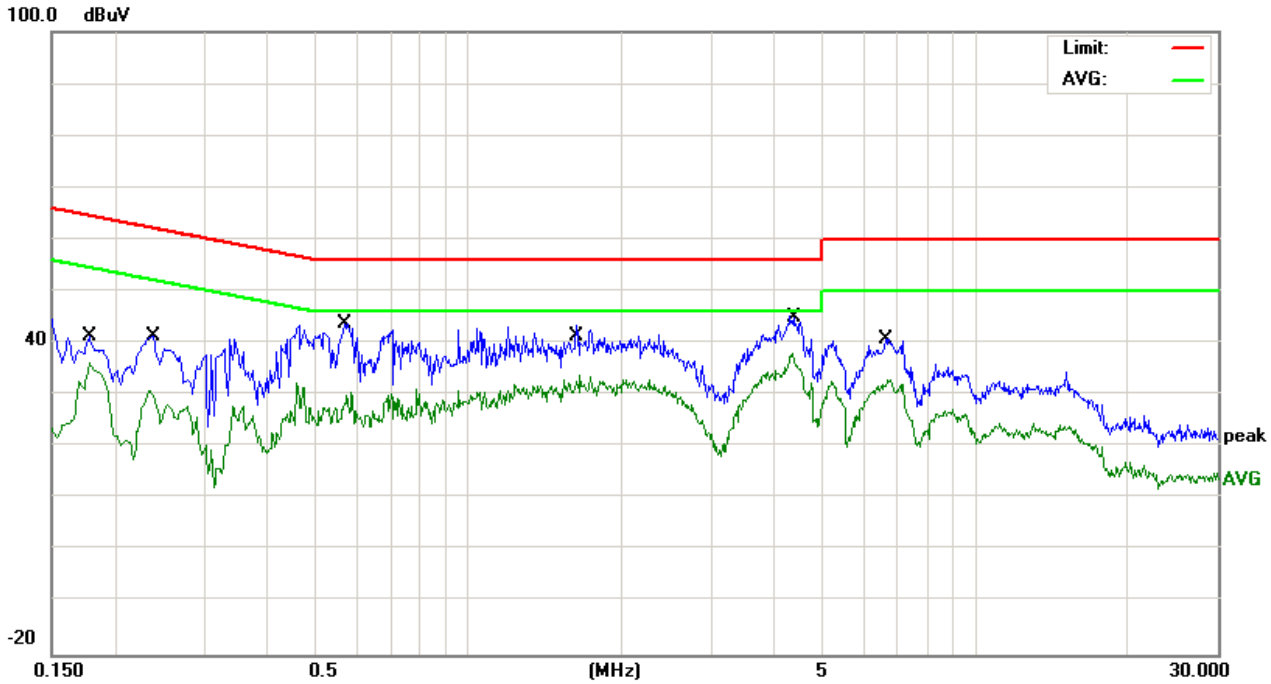
Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.



EUT：	Fingerprint smart terminal	Model Name. ：	BM5510
Temperature：	26 ℃	Relative Humidity：	56%
Pressure：	1010hPa	Phase :	N
Test Voltage ：	DC 5.0V form PC AC 240V/60Hz	Test Mode：	TM1_ Link

Frequency (MHz)	Reading Level (dBμV)	Correct Factor (dB)	Measurement (dBμV)	Limits (dBμV)	Margin (dB)	Remark
0.1779	32.01	9.46	41.47	64.58	-23.11	QP
0.1779	26.68	9.46	36.14	54.58	-18.44	AVG
0.2379	31.82	9.45	41.27	62.17	-20.90	QP
0.2379	21.28	9.45	30.73	52.17	-21.44	AVG
0.5699	34.41	9.45	43.86	56.00	-12.14	QP
0.5699	21.23	9.45	30.68	46.00	-15.32	AVG
1.6539	33.86	9.45	43.31	56.00	-12.69	QP
1.6539	24.32	9.45	33.77	46.00	-12.23	AVG
4.3499	35.89	9.48	45.37	56.00	-10.63	QP
4.3499	28.69	9.48	38.17	46.00	-7.83	AVG
6.7259	31.34	9.51	40.85	60.00	-19.15	QP
6.7259	23.48	9.51	32.99	50.00	-17.01	AVG

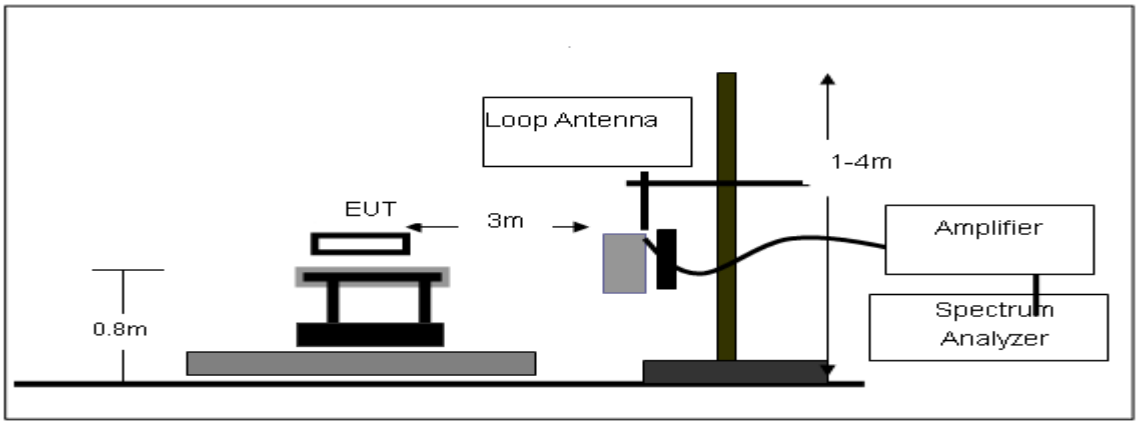
Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.



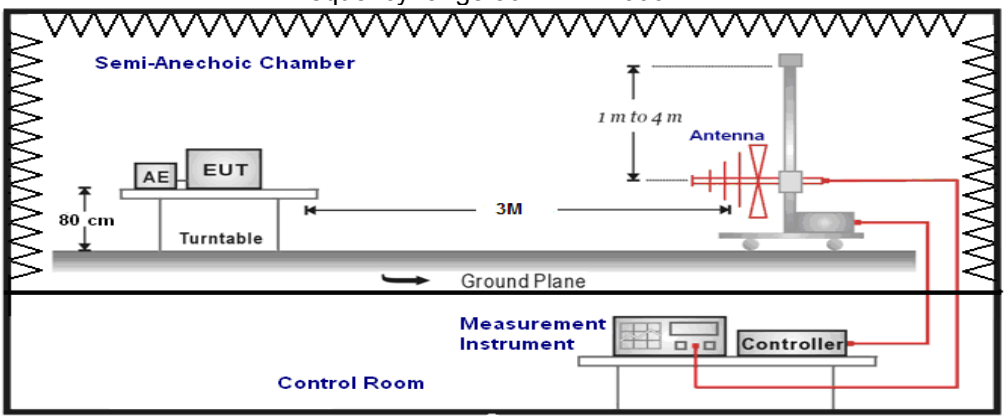
4.2 Radiated Emissions

TEST CONFIGURATION

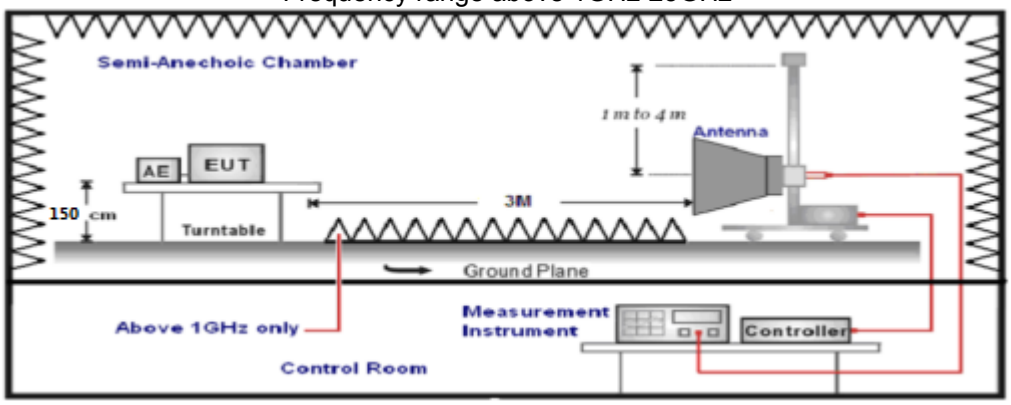
Frequency range 9 KHz – 30MHz



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 for below 1GHz and 1.50m above ground plane for above 1GHz.
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 32.768 KHz and maximum operation frequency was 2480MHz.so radiated emission test frequency band from 9 KHz 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	Bilog Antenna	3
1GHz-18GHz	Horn Antenna	3
18GHz-25GHz	Horn Anternna	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	Peak
	Average Value: RBW=1MHz/VBW=330Hz, Sweep time=Auto	Peak

More procudre as follows;

1) Sequence of testing 9 kHz to 30 MHz

Setup:
--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.
--- If the EUT is a floor standing device, it is placed on the ground.
--- Auxiliary equipment and cables were positioned to simulate normal operation conditions.
--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
--- The measurement distance is 3 meter.
--- The EUT was set into operation.

Premeasurement:
--- The turntable rotates from 0° to 315° using 45° steps.
--- The antenna height is 1.0 meter.
--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:
--- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).
--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QP detector.
--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

2) Sequence of testing 30 MHz to 1 GHz

Setup:
--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
--- Auxiliary equipment and cables were positioned to simulate normal operation conditions
--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
--- The measurement distance is 3 meter.
--- The EUT was set into operation.

Premeasurement:
--- The turntable rotates from 0° to 315° using 45° steps.
--- The antenna is polarized vertical and horizontal.
--- The antenna height changes from 1 to 4 meter.
--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:
--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter.
--- The final measurement will be done with QP detector with an EMI receiver.
--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

3) Sequence of testing 1 GHz to 18 GHz

Setup:
--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
--- Auxiliary equipment and cables were positioned to simulate normal operation conditions
--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
--- The measurement distance is 3 meter.
--- The EUT was set into operation.

Premeasurement:
--- The turntable rotates from 0° to 315° using 45° steps.
--- The antenna is polarized vertical and horizontal.
--- The antenna height scan range is 1 meter to 2.5 meter.
--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:
--- The final measurement will be performed with minimum the six highest peaks.
--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.
--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.
--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

4) Sequence of testing above 18 GHz

Setup:
--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
--- Auxiliary equipment and cables were positioned to simulate normal operation conditions
--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
--- The measurement distance is 1 meter.
--- The EUT was set into operation.

Premeasurement:
--- The antenna is moved spherical over the EUT in different polarizations of the antenna.
Final measurement:
--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.
--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

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	

For example

Frequency (MHz)	FS (dBμV/m)	RA (dBμV/m)	AF (dB)	CL (dB)	AG (dB)	Transd (dB)
300.00	40	58.1	12.2	1.6	31.90	-18.1

Transd=AF +CL-AG

RADIATION LIMIT

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission out of authorized band shall not exceed the following table at a 3 meters measurement distance.
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)

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	300	20log(2400/F(KHz))+80	2400/F(KHz)
0.49-1.705	30	20log(24000/F(KHz))+40	24000/F(KHz)
1.705-30	30	20log(30)+40	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:
1. The radiated measurement are performed the each test mode and channel (low/mid/high), the data recorded below (GFSK mode, the middle channel) is the worst case for all the test mode and channel.
2. Bilog Antenna for the radiation emission test below 1G.
3. HORN ANTENNA for the radiation emission test above 1G.
4. "---" means not recorded as emission levels lower than limit.
6. Margin= Level – Limit

For 9KHz to 30MHz

EUT	Fingerprint smart terminal	Model Name.	BM5510
Temperature	20 ℃	Relative Humidtity	48%
Pressure	1010 hPa	Test Voltage	DC 3.7V
Test Mode	TX	Polarization	--

Frequency (MHz)	Corrected Reading (dBμV/m)@3m	FCC Limit (dBμV/m) @3m	Margin (dB)	Detector	Result
--	--	--	--	QP	PASS
--	--	--	--	QP	PASS

Remark:

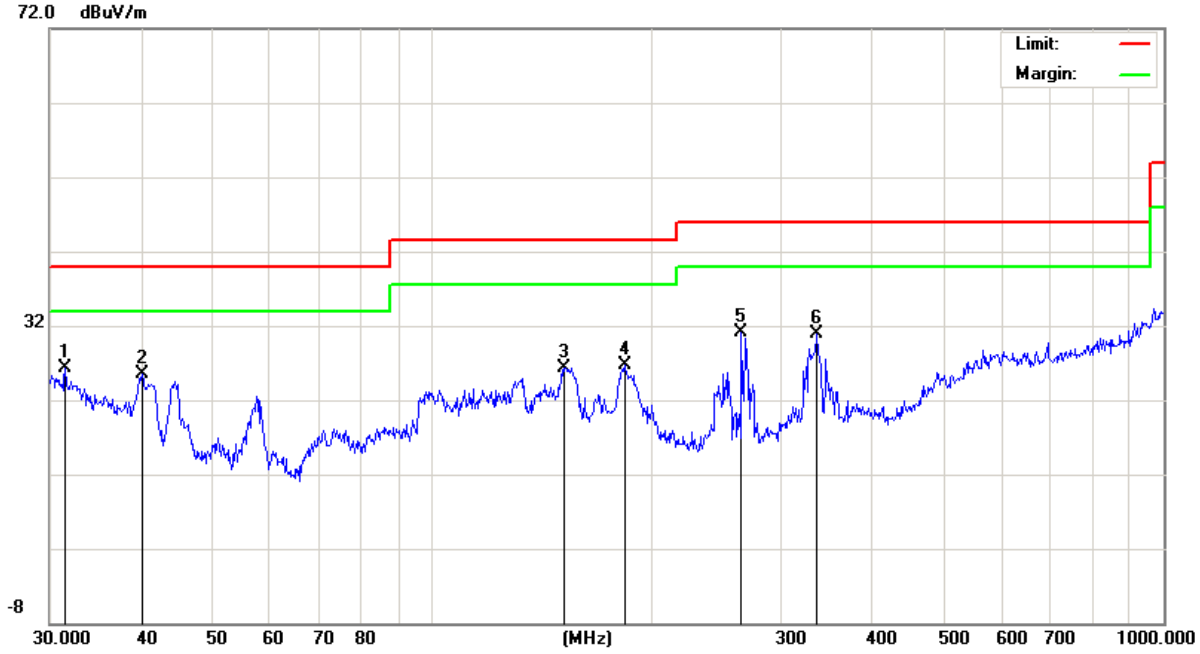
1. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
Distance extrapolation factor =40 log (specific distance/test distance)(dB);
Limit line = specific limits(dBuv) + distance extrapolation factor.

For 30MHz to 1000MHz

EUT	Fingerprint smart terminal	Model Name.	BM5510
Temperature	20 ℃	Relative Humidtity	48%
Pressure	1010 hPa	Test Voltage	DC 3.7V
Test Mode	TX-Mid CH		

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
H	31.5091	7.18	19.03	26.21	40.00	-13.79	peak
H	40.1347	11.01	14.48	25.49	40.00	-14.51	peak
H	151.5971	14.63	11.75	26.38	43.50	-17.12	peak
H	183.2005	14.90	11.85	26.75	43.50	-16.75	peak
H	264.7456	19.79	11.35	31.14	46.00	-14.86	peak
H	336.0350	17.05	13.82	30.87	46.00	-15.13	peak

Remark:
Absolute Level= ReadingLevel+ Factor, Margin= Absolute Level - Limit



For 1GHz to 25GHz

EUT	Fingerprint smart terminal	Model Name.	BM5510
Temperature	20 ℃	Relative Humidtity	48%
Pressure	1010 hPa	Test Voltage	DC 3.7V
Test Mode	TX		

Low Channel @ Channel 00 @ 2402 MHz

Frequency (MHz)	Reading (dBμV)	Factor (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Remark	Polar (H/V)
4804.102	60.23	-3.64	56.59	74.00	-17.41	PK	Vertical
4804.102	39.47	-3.64	35.83	54.00	-18.17	AV	Vertical
7206.247	60.09	-0.95	59.14	74.00	-14.86	PK	Vertical
7206.247	41.15	-0.95	40.20	54.00	-13.80	AV	Vertical
4804.332	63.52	-3.64	59.88	74.00	-14.12	PK	Horizontal
4804.332	42.48	-3.64	38.84	54.00	-15.16	AV	Horizontal
7206.167	60.29	-0.95	59.34	74.00	-14.66	PK	Horizontal
7206.167	41.11	-0.95	40.16	54.00	-13.84	AV	Horizontal

Middle Channel @ Channel 19 @ 2440 MHz

Frequency (MHz)	Reading (dBμV)	Factor (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Remark	Polar (H/V)
4880.203	59.68	-3.68	56.00	74.00	-18.00	PK	Vertical
4880.203	40.77	-3.68	37.09	54.00	-16.91	AV	Vertical
7320.158	59.85	-0.82	59.03	74.00	-14.97	PK	Vertical
7320.158	41.16	-0.82	40.34	54.00	-13.66	AV	Vertical
4880.184	63.35	-3.68	59.67	74.00	-14.33	PK	Horizontal
4880.184	41.04	-3.68	37.36	54.00	-16.64	AV	Horizontal
7320.349	60.29	-0.82	59.47	74.00	-14.53	PK	Horizontal
7320.349	43.22	-0.82	42.40	54.00	-11.60	AV	Horizontal

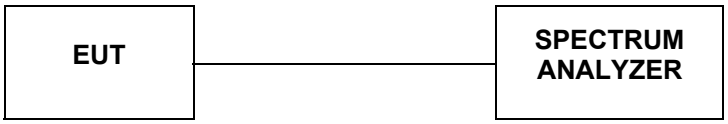
High Channel @ Channel 39 @ 2480 MHz

Frequency (MHz)	Reading (dBμV)	Factor (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Remark	Polar (H/V)
4960.111	61.13	-3.59	57.54	74.00	-16.46	PK	Vertical
4960.111	40.96	-3.59	37.37	54.00	-16.63	AV	Vertical
7440.195	60.03	-0.68	59.35	74.00	-14.65	PK	Vertical
7440.195	47.41	-0.68	46.73	54.00	-7.27	AV	Vertical
4960.403	60.02	-3.59	56.43	74.00	-17.57	PK	Horizontal
4960.403	42.46	-3.59	38.87	54.00	-15.13	AV	Horizontal
7440.106	59.65	-0.68	58.97	74.00	-15.03	PK	Horizontal
7440.106	42.25	-0.68	41.57	54.00	-12.43	AV	Horizontal

Remark:
1. Absolute Level= ReadingLevel+ Factor, Margin= Absolute Level - Limit
2. The other emission levels were very low against the limit.
3. Margin = Emission Level - Limits.
4. The average measurement was not performed when the peak measured data under the limit of average detection.
5. Detector AV is setting spectrum/receiver. RBW=1MHz/VBW=330Hz/Sweep time=Auto/Detector=Peak;
6."---" Mean the PK detector measured value is below average limit.

4.3 Duty Cycle

TEST CONFIGURATION



LIMIT

The Maximum Peak Output Power Measurement is 30dBm.
Preferably, all measurements of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%).
When continuous transmission cannot be achieved and sweep triggering/signal gating cannot be implemented, alternate procedures are provided that can be used to measure the average power; however, they will require an additional measurement of the transmitter duty cycle. Within this guidance document, the duty cycle refers to the fraction of time over which the transmitter is on and is transmitting at its maximum power control level. The duty cycle is considered to be constant if variations are less than ± 2 percent, otherwise the duty cycle is considered to be non-constant.

TEST PROCEDURE

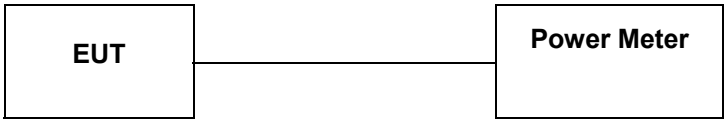
a. A diode detector and an oscilloscope that together have sufficiently short response time to permit accurate measurements of the on and off times of the transmitted signal.
b. The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient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

TEST RESULTS

The Manufacturer provide engineer mode to setup 100% continuous transmit for Bluetooth Lower Energy.

4.4 Maximum Peak Output Power

TEST CONFIGURATION



TEST PROCEDURE

According to KDB558074 D01 DTS Meas Guidance:
PKPM1 Peak power meter method: 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.
Maximum conducted (average) output power: As an alternative to spectrum analyzer or EMI receiver measurements, measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied.
1. The EUT is configured to transmit continuously, or to transmit with a constant duty factor.
2. At all times when the EUT is transmitting, it shall be transmitting at its maximum power control level.
3. The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.
If the transmitter does not transmit continuously, measure the duty cycle (x) of the transmitter output signal as described in Section 6.0.
Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
Adjust the measurement in dBm by adding 10log (1/x), where x is the duty cycle to the measurement result.

LIMIT

The Maximum Peak Output Power Measurement is 30dBm.

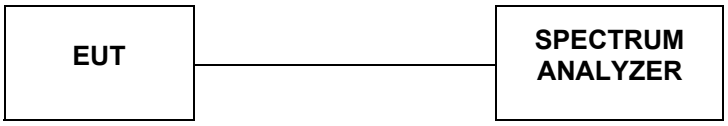
TEST RESULTS

Test Mode	Channel	Frequency (MHz)	Measured Maximum Peak Power (dBm)	Limits (dBm)	Verdict
GFSK-BLE	00	2402	-4.60	30	PASS
	19	2440	-4.17		
	39	2480	-4.34		

Remark:
1. *Test results including cable loss;*

4.5 Power Spectral Density

TEST CONFIGURATION



TEST PROCEDURE

According to KDB 558074 D01 Method PKPSD (peak PSD) this procedure shall be used if maximum peak conducted output power was used to demonstrate compliance, and is optional if the maximum conducted (average) output power was used to demonstrate compliance.
1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

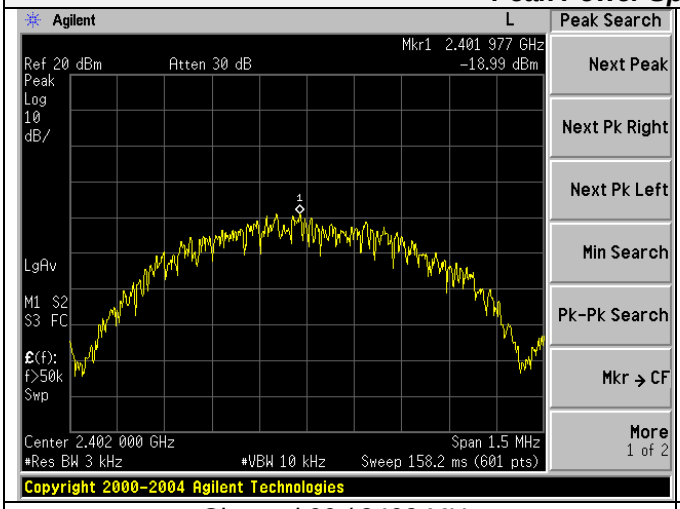
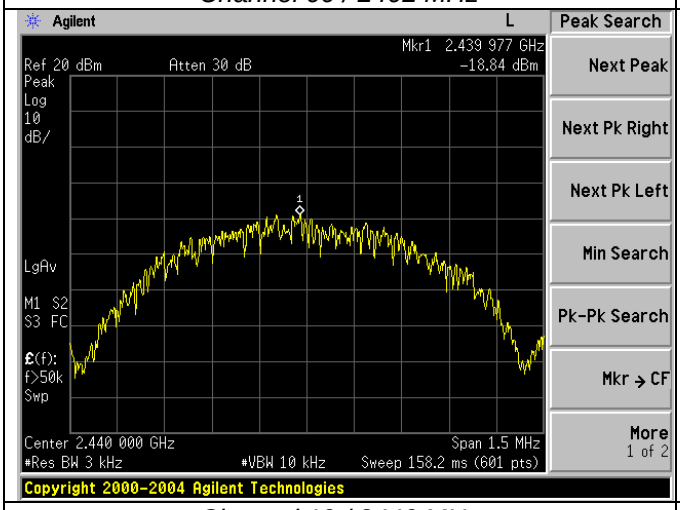
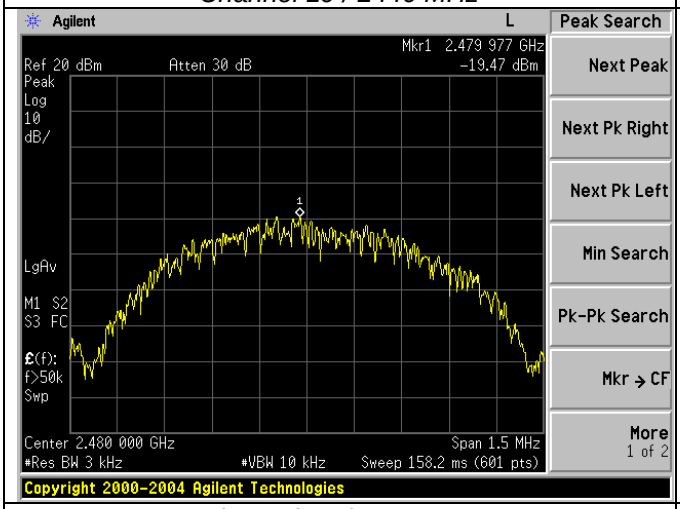
LIMIT

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

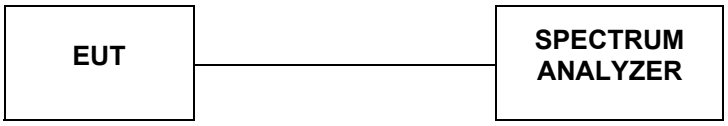
Test Mode	Channel	Frequency (MHz)	Measured Peak Power Spectral Density (dBm/3KHz)	Limits (dBm/3KHz)	Verdict
GFSK-BLE	00	2402	-18.99	8	PASS
	19	2440	-18.84		
	39	2480	-19.47		

Remark:
1. *Test results including cable loss;*
2. *please refer to following plots;*

Peak Power Spectral Density	
	
Channel 00 / 2402 MHz	
	
Channel 19 / 2440 MHz	
	
Channel 39 / 2480 MHz	

4.6 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 with100 KHz RBW and 300KHz VBW.
The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB.
According to KDB558074 D01 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.

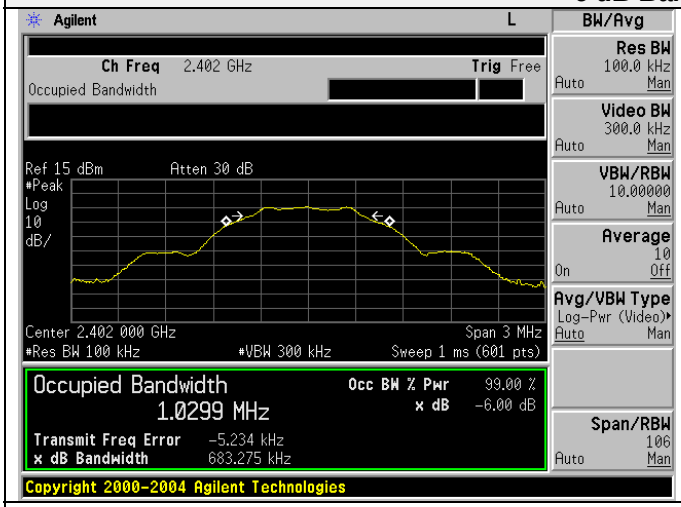
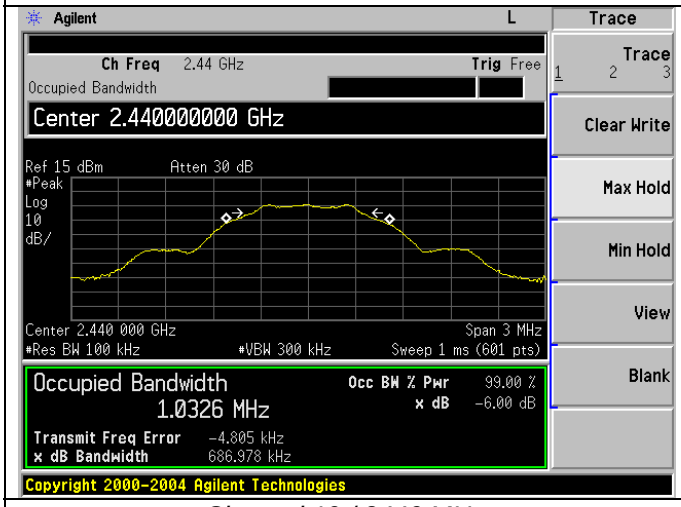
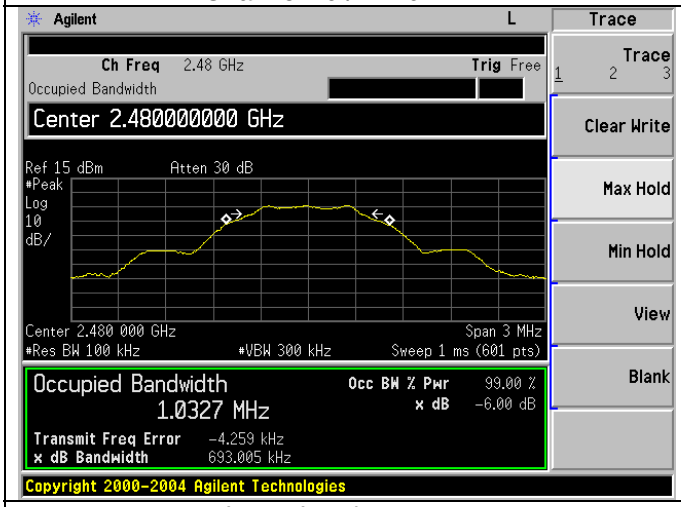
LIMIT

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

TEST RESULTS

Test Mode	Channel	Frequency (MHz)	Measured 6 dB Bandwidth (MHz)	Limits (MHz)	Verdict
GFSK-BLE	00	2402	0.6833	≥0.5000	PASS
	19	2440	0.6870		
	39	2480	0.6930		

Remark:
1. *Test results including cable loss;*
2. *please refer to following plots;*

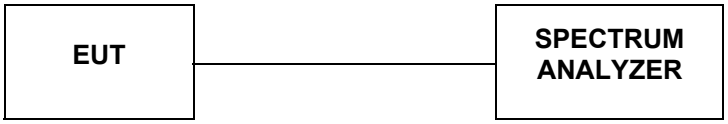
6 dB Bandwidth	
	
Channel 0 / 2402 MHz	
	
Channel 19 / 2440 MHz	
	
Channel 39 / 2480 MHz	

4.7 Band-edge Measurements for Radiated Emissions

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

According to KDB 558074 D01 for Antenna-port conducted measurement. Antenna-port conducted measurements may also be used as an alternative to radiated measurements for demonstrating compliance in the restricted frequency bands. If conducted measurements are performed, then proper impedance matching must be ensured and an additional radiated test for cabinet/case spurious emissions is required.

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, for Radiated emissions restricted band RBW=1MHz, VBW=3MHz for peak detector and RBW=1MHz, VBW=10Hz for Peak detector.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.
6. Measure the conducted output power (in dBm) using the detector specified by the appropriate regulatory agency (see 12.2.2, 12.2.3, and 12.2.4 for guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).
7. Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see 12.2.5 for guidance on determining the applicable antenna gain)
8. Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies ≤ 30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies > 1000 MHz).
9. For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (e.g., Watts, mW).
10. Convert the resultant EIRP level to an equivalent electric field strength using the following relationship:
    E = EIRP – 20log D + 104.8

where:
E = electric field strength in dBμV/m,
EIRP = equivalent isotropic radiated power in dBm
D = specified measurement distance in meters.

11. Since the out-of-band characteristics of the EUT transmit antenna will often be unknown, the use of a conservative antenna gain value is necessary. Thus, when determining the EIRP based on the measured conducted power, the upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands, or 2 dBi, whichever is greater. However, for devices that operate in multiple frequency bands while using the same transmit antenna, the highest gain of the antenna within the operating band nearest in frequency to the restricted band emission being measured may be used in lieu of the overall highest gain when the emission is at a frequency that is within 20 percent of the nearest band edge frequency, but in no case shall a value less than 2 dBi be used.
12. Compare the resultant electric field strength level to the applicable regulatory limit.
13. Perform radiated spurious emission test dures until all measured frequencies were complete.

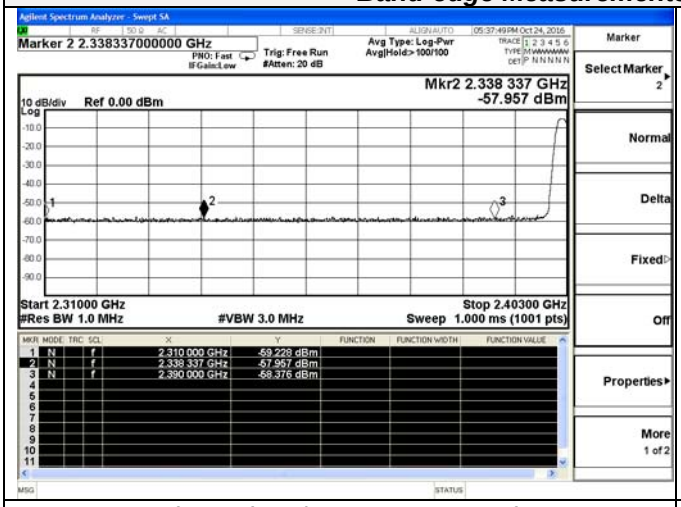
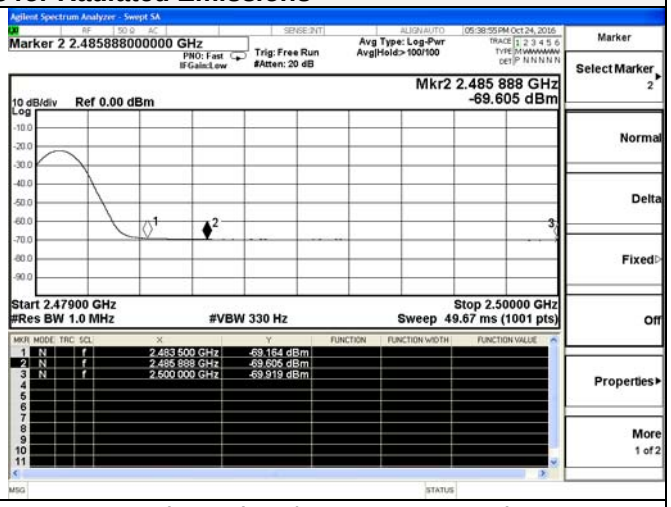
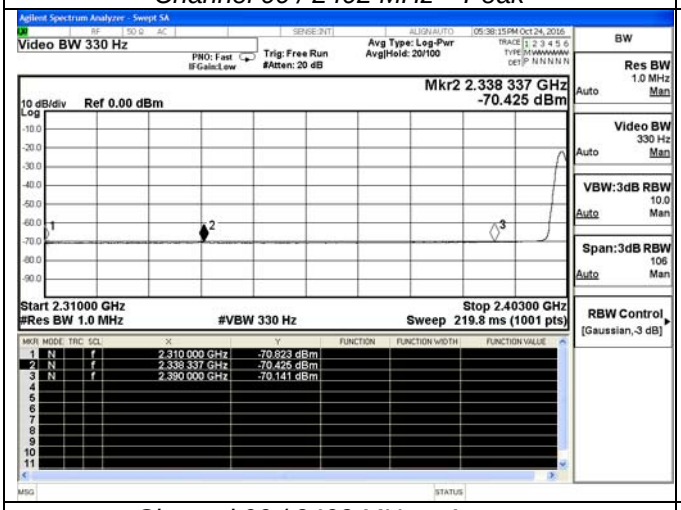
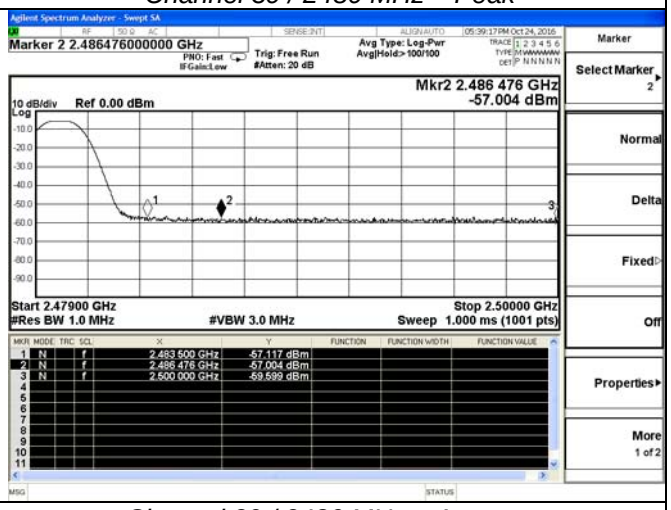
LIMIT

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

GFSK – BLE							
Frequency (MHz)	**Conducted Power (dBm)**	**Antenna Gain (dBi)**	**Ground Reflection Factor (dB)**	**Covert Radiated E Level At 3m (dBuV/m)**	**Detector**	**Limit (dBuV/m)**	**Verdict**
2390.000	-58.376	2.00	0.00	38.884	Peak	74.00	PASS
2390.000	-70.141	2.00	0.00	27.119	AV	54.00	PASS
2338.337	-57.975	2.00	0.00	39.285	Peak	74.00	PASS
2338.337	-70.425	2.00	0.00	26.835	AV	54.00	PASS
2310.000	-59.228	2.00	0.00	38.032	Peak	74.00	PASS
2310.000	-70.823	2.00	0.00	26.437	AV	54.00	PASS
2483.500	-57.117	2.00	0.00	40.143	Peak	74.00	PASS
2483.500	-69.164	2.00	0.00	28.096	AV	54.00	PASS
2486.476	-57.004	2.00	0.00	40.256	Peak	74.00	PASS
2485.888	-69.605	2.00	0.00	27.655	AV	54.00	PASS
2500.000	-59.559	2.00	0.00	37.701	Peak	74.00	PASS
2500.000	-69.619	2.00	0.00	27.641	AV	54.00	PASS

Remark:
1. *Test results including cable loss;*
2. *"---" means that the fundamental frequency not for 15.209 limits requirement.*
3. *please refer to following plots;*

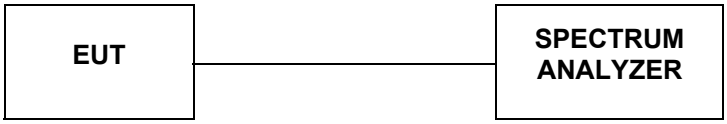
Band-edge Measurements for Radiated Emissions	
	
Channel 00 / 2402 MHz – Peak	*Channel 39 / 2480 MHz – Peak*
	
Channel 00 / 2402 MHz – Average	*Channel 39 / 2480 MHz – Average*

4.8 Band-edge Measurements for RF Conducted Emissions

LIMIT

1. Below -20dB of the highest emission level in operating band.
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

TEST CONFIGURATION



TEST PROCEDURE

According to KDB 558074 D01 for Antenna-port conducted measurement.

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge,
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.
6. Measure the conducted output power (in dBm) using the detector specified by the appropriate regulatory agency (see 12.2.2, 12.2.3, and 12.2.4 for guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).

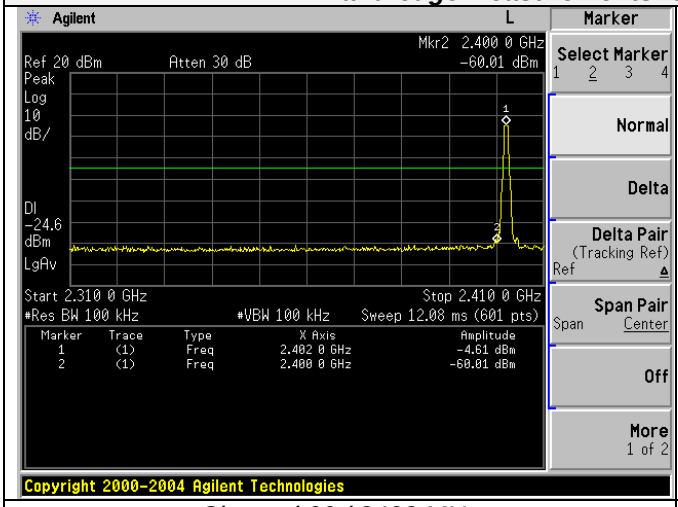
TEST RESULTS

Test Mode	Channel	Frequency (MHz)	Conductd Band-edge Emission (dBc)	Limits (dBc)	Verdict
GFSK-BLE	00	2402	<-20dBc	-20	PASS
	39	2480	<-20dBc	-20	

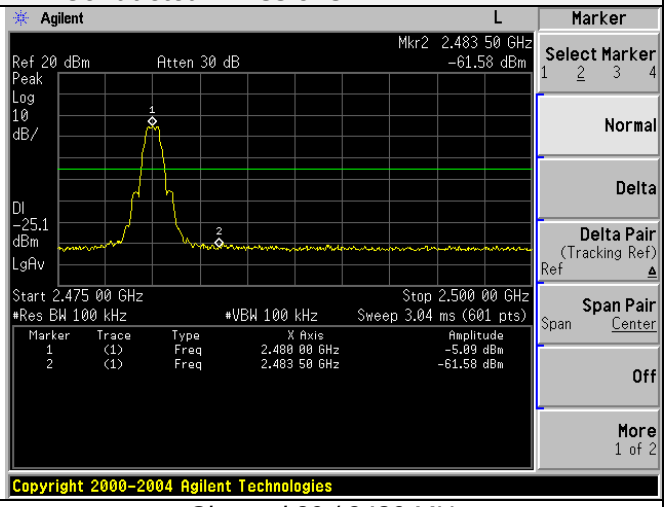
Remark:

1. *Test results including cable loss;*
2. *"---" means that the fundamental frequency not for 15.209 limits requirement.*
3. *please refer to following plots;*

Band-edge Measurements for RF Conducted Emissions



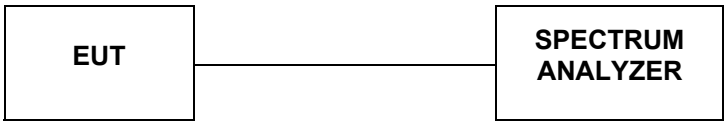
Channel 00 / 2402 MHz



Channel 39 / 2480 MHz

4.9 Spurious RF Conducted Emission

TEST CONFIGURATION



TEST PROCEDURE

The Spurious RF conducted emissions compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10-2013 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW=100 kHz and VBW= 300 KHz to measure the peak field strength, and measure frequency range from 9 KHz to 25GHz.

LIMIT

1. Below -20dB of the highest emission level in operating band.
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

TEST RESULTS

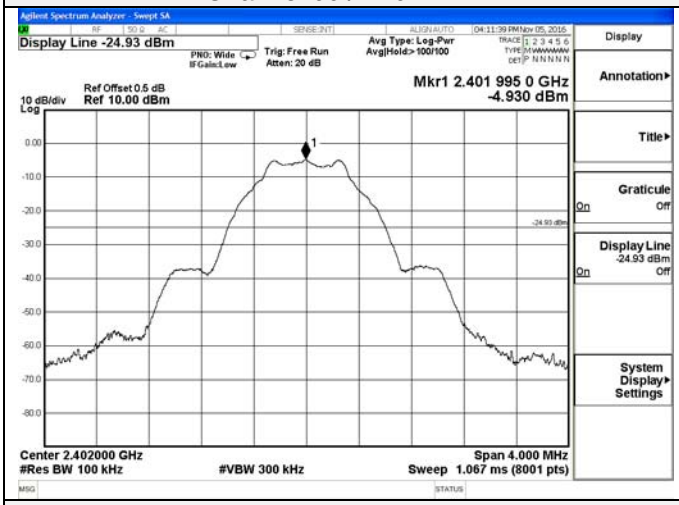
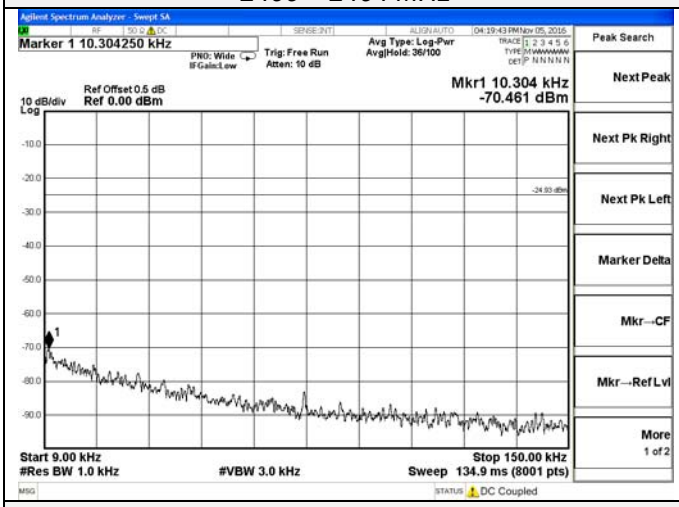
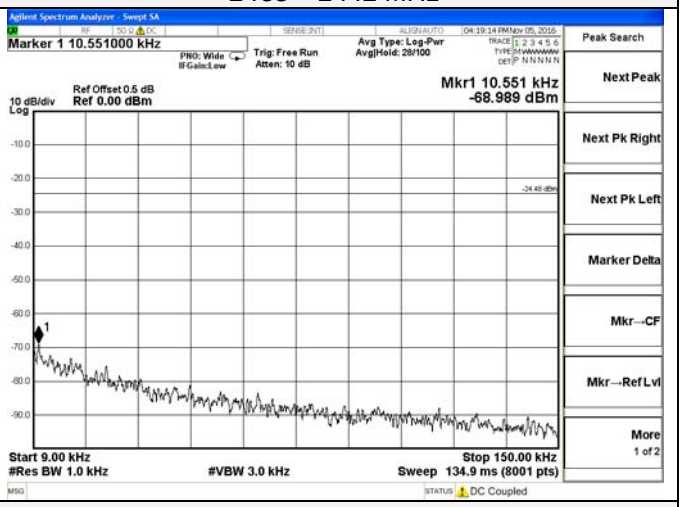
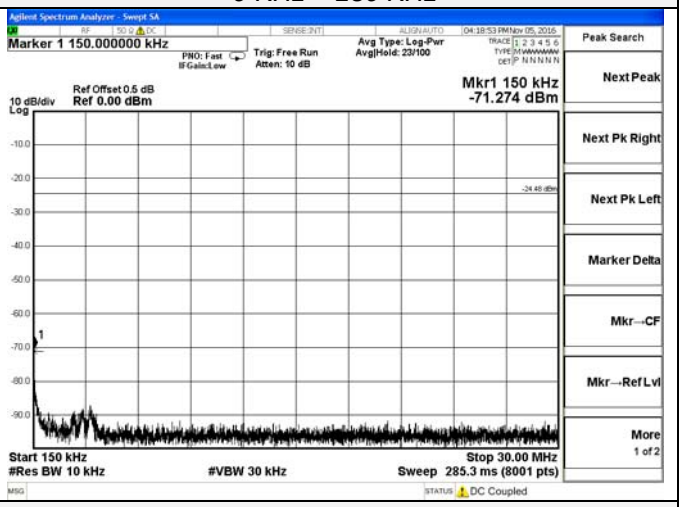
1. Below -20dB of the highest emission level in operating band.
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

TEST RESULTS

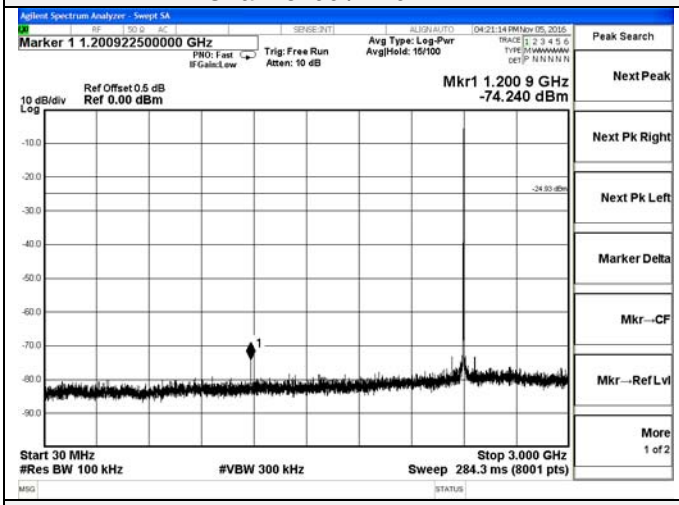
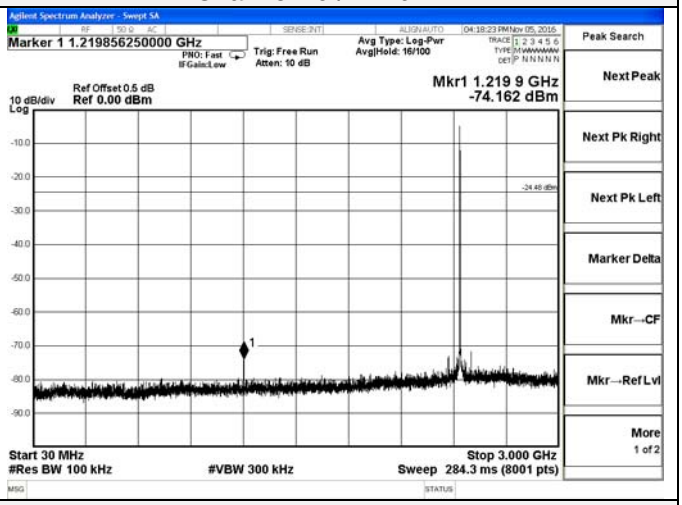
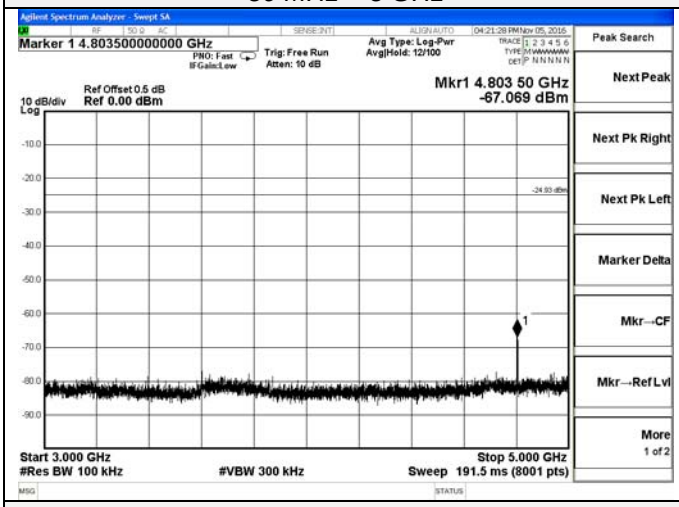
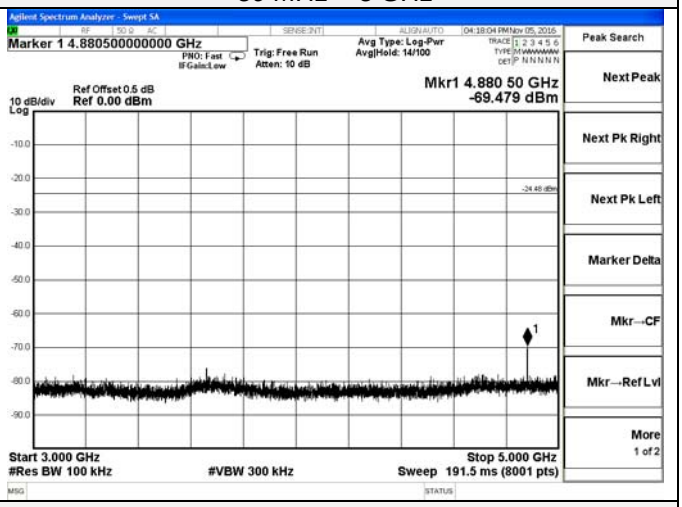
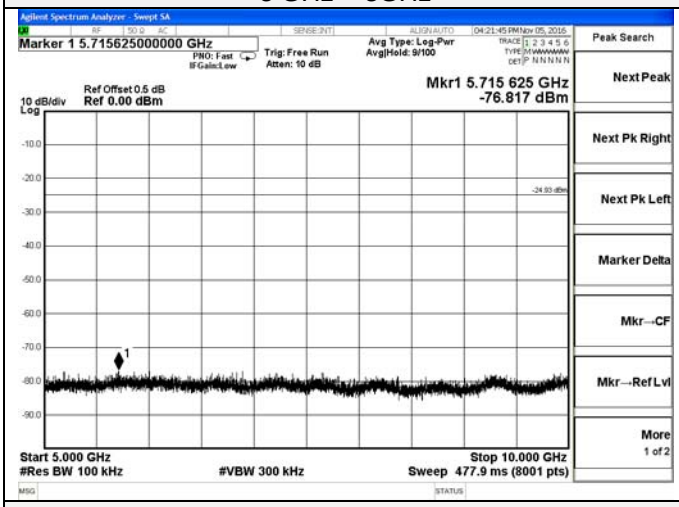
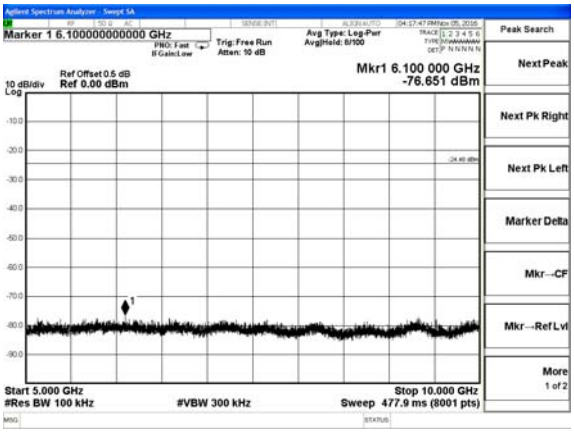
Test Mode	Channel	Frequency (MHz)	Spurious RF Conducted Emission (dBc)	Limits (dBc)	Verdict
GFSL-BLE	00	2402	<-20dBc	-20	PASS
	19	2440	<-20dBc	-20	
	39	2480	<-20dBc	-20	

Remark:
1. *Test results including cable loss;*
2. *"---" means that the fundamental frequency not for 15.209 limits requirement.*
3. *please refer to following plots;*

Spurious RF Conducted Emissions

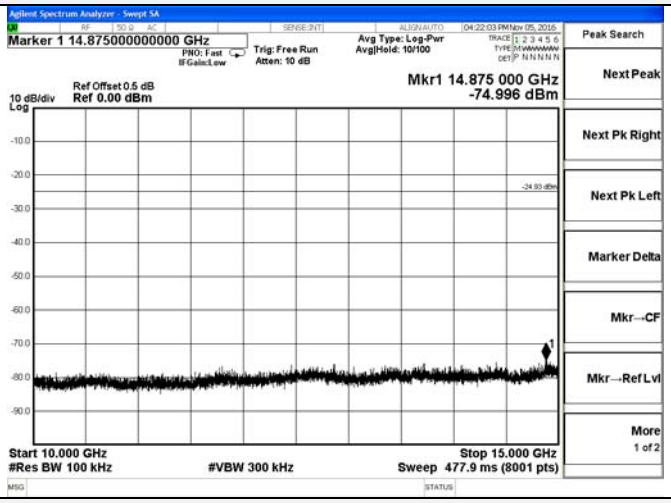
Channel 00 / 2402 MHz	Channel 19 / 2440 MHz
	
2400 – 2404 MHz	2438 – 2442 MHz
	
9 KHz – 150 KHz	9 KHz – 150 KHz
	
150 KHz – 30 MHz	150 KHz – 30 MHz

Spurious RF Conducted Emissions

Channel 00 / 2402 MHz	Channel 19 / 2440 MHz
	
30 MHz – 3 GHz	*30 MHz – 3 GHz*
	
3 GHz – 5GHz	*3 GHz – 5GHz*
	
5 GHz – 10GHz	*5 GHz – 10GHz*

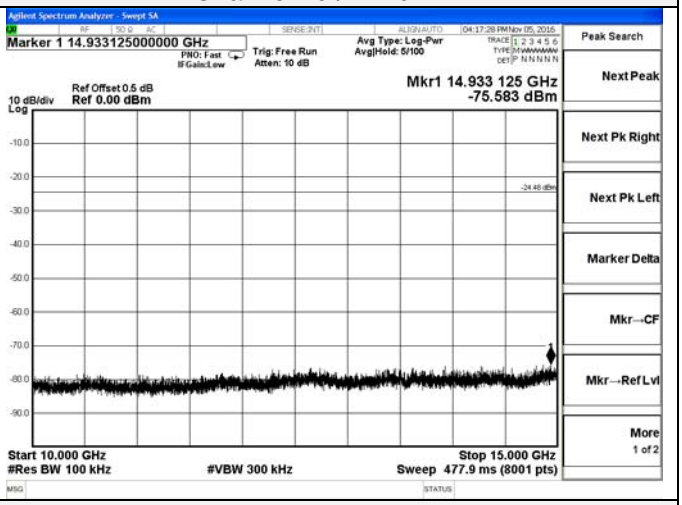
Spurious RF Conducted Emissions

Channel 00 / 2402 MHz

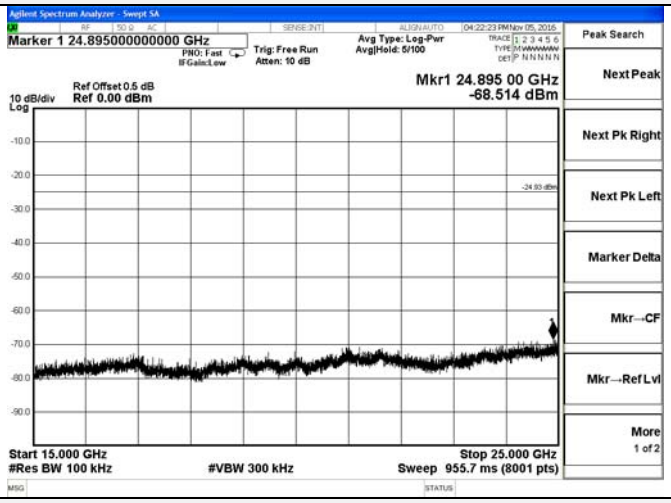


10 GHz – 15 GHz

Channel 19 / 2440 MHz

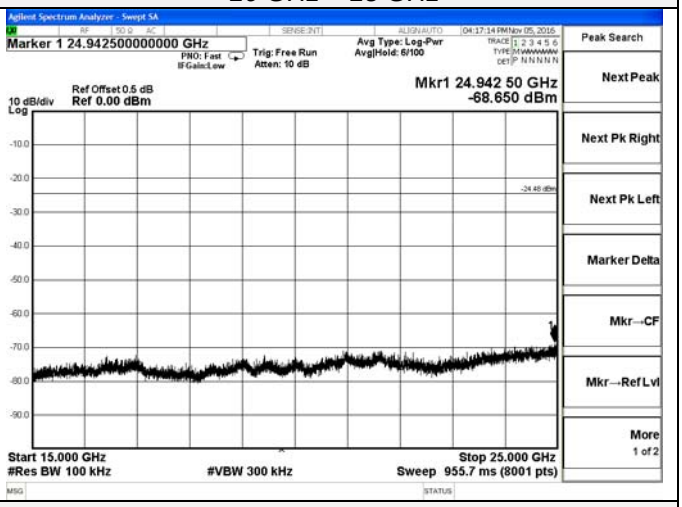


10 GHz – 15 GHz



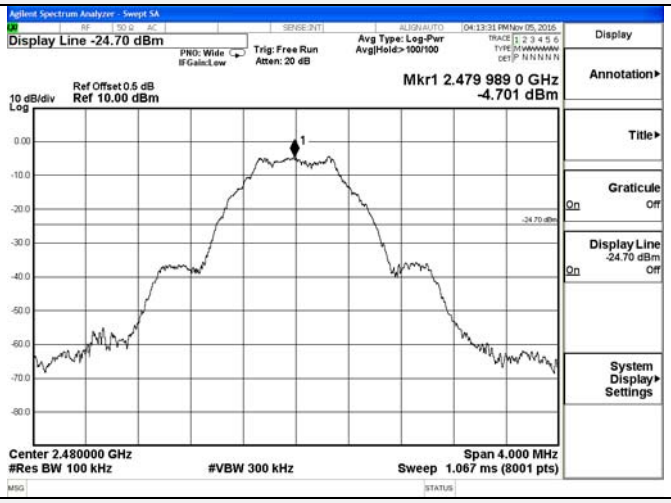
15 GHz – 20 GHz

15 GHz – 20 GHz



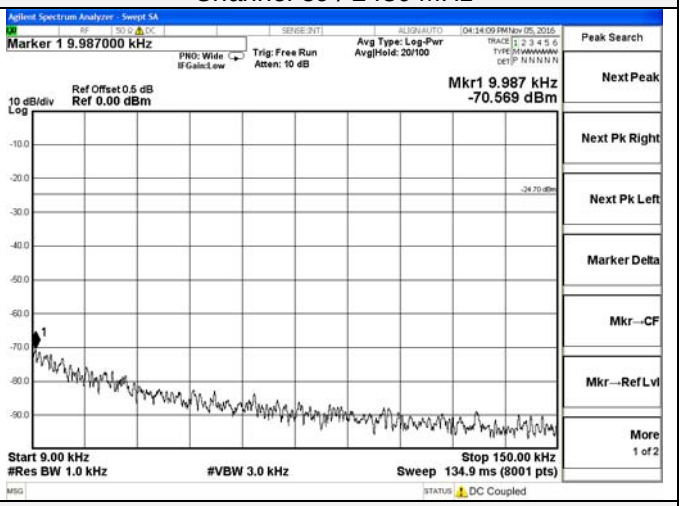
15 GHz – 20 GHz

Channel 39 / 2480 MHz



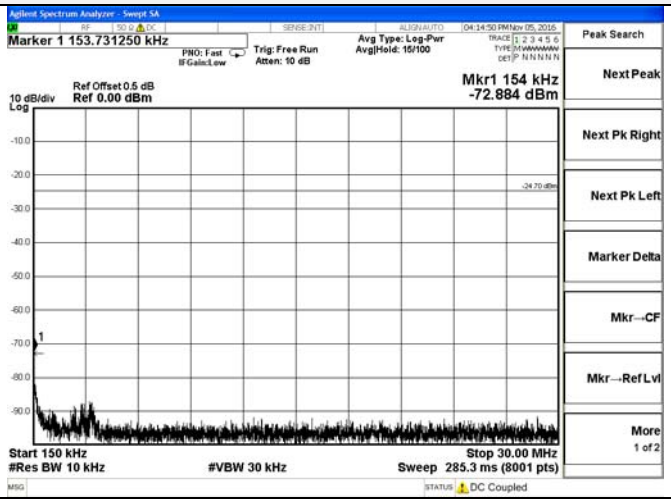
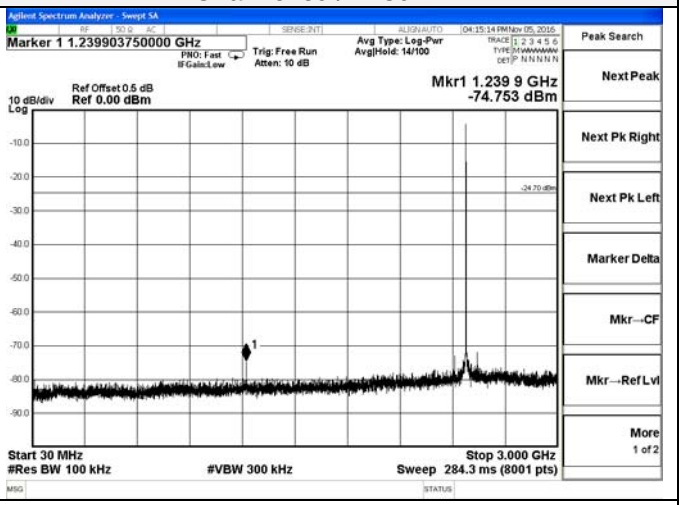
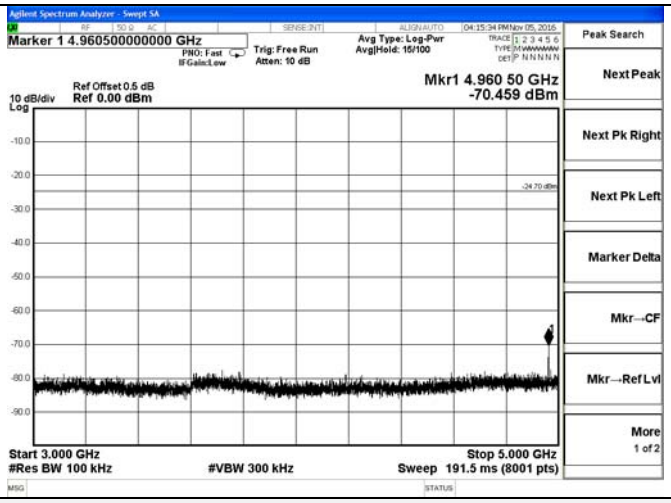
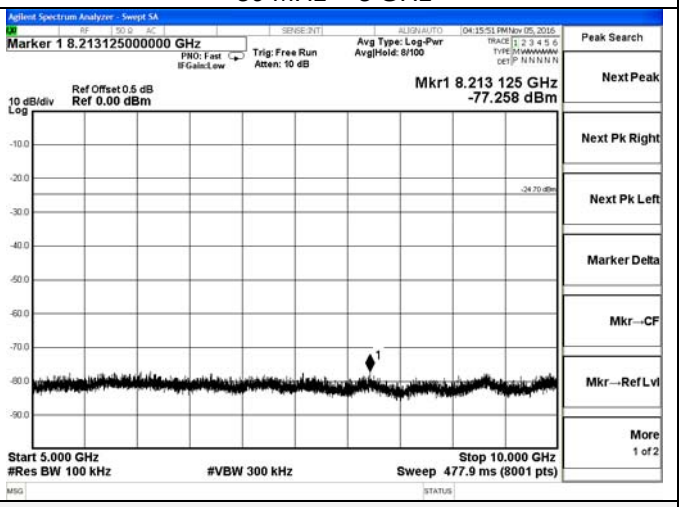
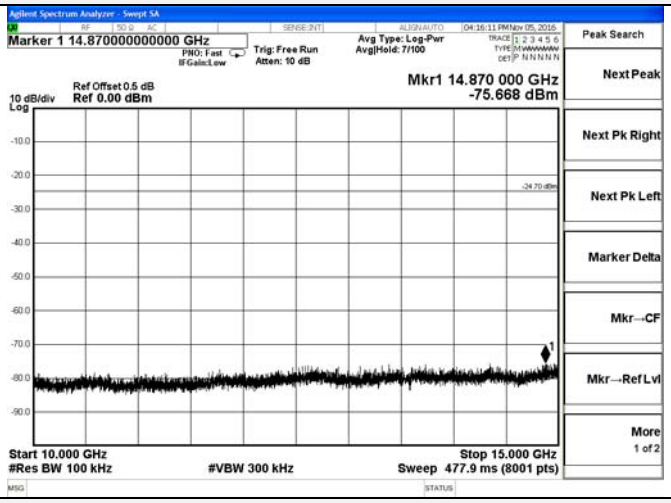
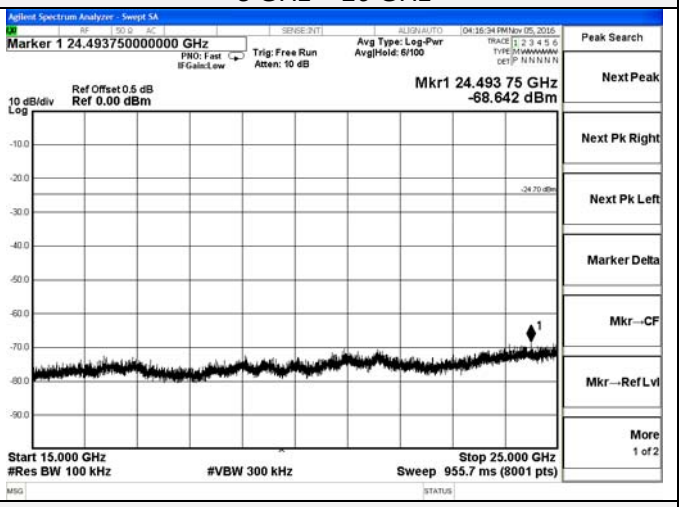
2478 MHz – 2482 MHz

Channel 39 / 2480 MHz



9 KHz – 150 KHz

Spurious RF Conducted Emissions

Channel 39 / 2480 MHz	Channel 39 / 2480 MHz
	
150 KHz – 30 MHz	30 MHz – 3 GHz
	
3 GHz – 5 GHz	5 GHz – 10 GHz
	
10 GHz – 15 GHz	15 GHz – 20 GHz

4.10 Antenna Requirement

Standard Applicable

For intentional device, according to FCC 47 CFR 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.

And according to FCC 47 CFR Section 15.247 (c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Refer to statement below for compliance

The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

Antenna Connected Construction

According to § 15.203 & RSS-Gen, 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.

Antenna Connector Construction

The directional gains of antenna used for transmitting is 1 dBi, and the antenna is an internal antenna connect to PCB board and no consideration of replacement. Please see EUT photo for details.
The WLAN and Bluetooth share same antenna.

Measurement

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module.

Conducted power refer ANSI C63.10 :2013 Output power test procedure for DTS devices
Radiated power refer to ANSI C63.10 :2013 Radiated emissions tests.

Measurement parameters

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1MHz
Video bandwidth:	3MHz
Trace-Mode:	Max hold

Limits

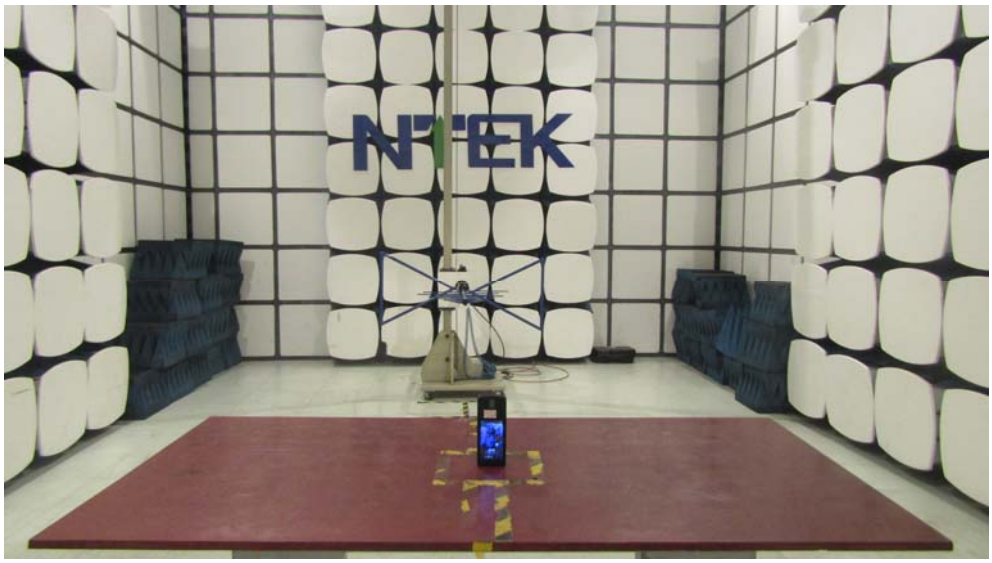
FCC	IC
Antenna Gain	
6 dBi	

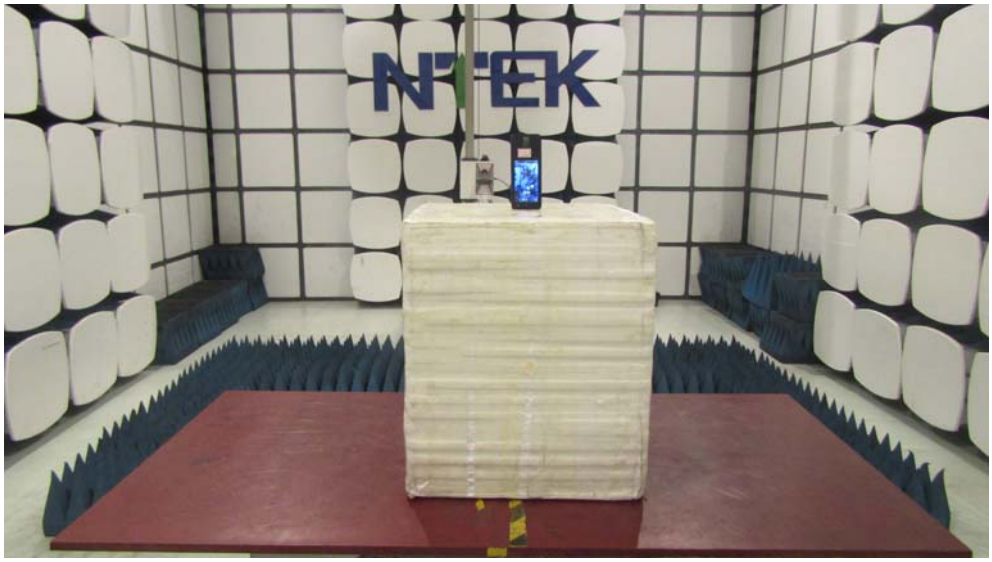
Results

T_{nom}	V_{nom}	Lowest Channel 2402 MHz	Middle Channel 2440 MHz	Highest Channel 2480 MHz
Conducted power [dBm] Measured with GFSK modulation		-4.54	-4.11	-4.34
Radiated power [dBm] Measured with GFSK modulation		-5.37	-3.46	-5.45
Gain [dBi] Calculated		-0.83	0.65	-1.11
Measurement uncertainty		± 0.16 dB (cond.) / ± 2.78 dB (rad.)		

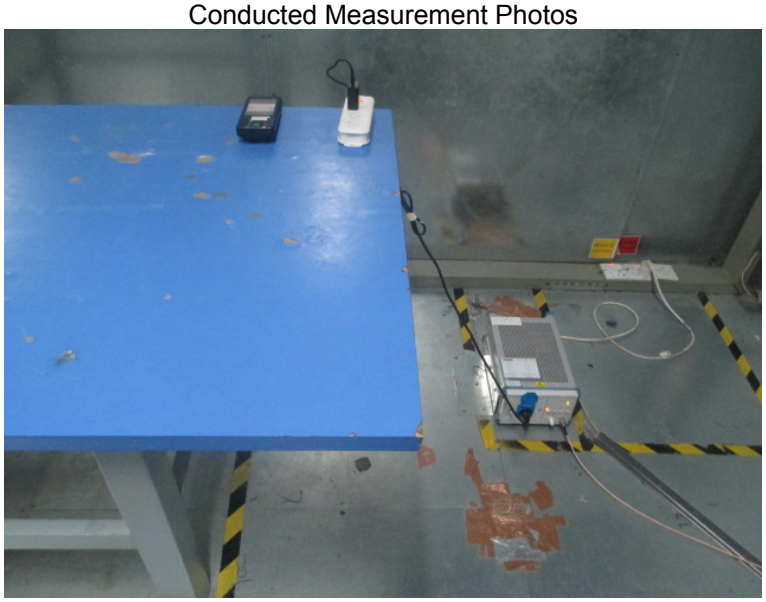
5 Test Setup Photos of the EUT

Radiated Measurement Photos





Conducted Measurement Photos



6 External Photos of the EUT

Please refer to separated files for External Photos of the EUT.

7 Internal Photos of the EUT

Please refer to separated files for Internal Photos of the EUT.

.....End of Report.....