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Shenzhen, Guangdong, China 518057

Telephone: +86 (0) 755 2601 2053 Report No.: SZEM180300235701

Fax: +86 (0) 755 2671 0594 Page: 1 of 51

TEST REPORT

Application No.: SZEM1803002357CR

Applicant: DNC TECHNOLOGIES LIMITED

Address of Applicant: 1B HIGH STREET SWANLEY BR8 8AE UK

Manufacturer: DNC TECHNOLOGIES LIMITED

Address of Manufacturer: 1B HIGH STREET SWANLEY BR8 8AE UK **Factory:** SHENZHEN FENDA TECHNOLOGY CO., LTD

Address of Factory: FENDA HI-TECH PARK, ZHOUSHI ROAD SHIYAN, BAOAN, SHENZHEN,

CHINA

Equipment Under Test (EUT):

EUT Name: Brushlink

Model No.: DNC-BR020

Trade mark: Brushlink

FCC ID: 2APQT-DNC-BR020-F

Standard(s): 47 CFR Part 15, Subpart C 15.247

Date of Receipt: 2018-04-17

Date of Test: 2018-04-18 to 2018-04-19

Date of Issue: 2018-04-24

Test Result: Pass*



Keny Xu EMC Laboratory Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.

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^{*} In the configuration tested, the EUT complied with the standards specified above.



Report No.: SZEM180300235701

Page: 2 of 51

	Revision Record							
Version Chapter Date Modifier Re								
01		2018-04-24		Original				

Authorized for issue by:		
	Moon. Zhang	
	Moon Zhang /Project Engineer	
	EvicFu	
	Eric Fu /Reviewer	



Report No.: SZEM180300235701

Page: 3 of 51

2 Test Summary

Radio Spectrum Technical Requirement							
Item Standard Method Requirement Result							
Antenna Requirement	47 CFR Part 15, Subpart C 15.247	N/A	47 CFR Part 15, Subpart C 15.203 & 15.247(c)	Pass			

Radio Spectrum Matter Part						
Item	Standard	Method	Requirement	Result		
Minimum 6dB Bandwidth	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.8.1	47 CFR Part 15, Subpart C 15.247a(2)	Pass		
Conducted Peak Output Power	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.9.1	47 CFR Part 15, Subpart C 15.247(b)(3)	Pass		
Power Spectrum Density	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.10.2	47 CFR Part 15, Subpart C 15.247(e)	Pass		
Conducted Band Edges Measurement	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.13.3.2	47 CFR Part 15, Subpart C 15.247(d)	Pass		
Conducted Spurious Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.11	47 CFR Part 15, Subpart C 15.247(d)	Pass		
Radiated Emissions which fall in the restricted bands	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.10.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass		
Radiated Spurious Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.4,6.5,6.6	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass		



Report No.: SZEM180300235701

Page: 4 of 51

3 Contents

			Page
1	COVE	R PAGE	1
2	TEST	SUMMARY	3
3	CONT	ENTS	Δ
Ŭ			
4	GENE	RAL INFORMATION	6
		DETAILS OF E.U.T	
		DESCRIPTION OF SUPPORT UNITS	
		MEASUREMENT UNCERTAINTY	
		EST LOCATION	
		EST FACILITY	
		DEVIATION FROM STANDARDS	
		ABNORMALITIES FROM STANDARD CONDITIONS	
5	EQUIF	PMENT LIST	9
_	DADU	CONTRUM TECHNICAL REQUIREMENT	40
6		SPECTRUM TECHNICAL REQUIREMENT	
	6.1 <i>A</i>	ANTENNA REQUIREMENT	
	6.1.1	Test Requirement:	
	6.1.2	Conclusion	
7	RADIO	O SPECTRUM MATTER TEST RESULTS	13
	7.1 N	AINIMUM 6DB BANDWIDTH	13
	7.1.1	E.U.T. Operation	
	7.1.2	Test Setup Diagram	
	7.1.3	Measurement Procedure and Data	
	7.2	CONDUCTED PEAK OUTPUT POWER	14
	7.2.1	E.U.T. Operation	
	7.2.2	Test Setup Diagram	
	7.2.3	Measurement Procedure and Data	
		POWER SPECTRUM DENSITY	
	7.3.1 7.3.2	E.U.T. Operation Test Setup Diagram	
	7.3.2 7.3.3	Measurement Procedure and Data	
		Conducted Band Edges Measurement	
	7.4.1	E.U.T. Operation	
	7.4.2	Test Setup Diagram	
	7.4.3	Measurement Procedure and Data	
	7.5	CONDUCTED SPURIOUS EMISSIONS	17
	7.5.1	E.U.T. Operation	
	7.5.2	Test Setup Diagram	
	7.5.3	Measurement Procedure and Data	
		RADIATED EMISSIONS WHICH FALL IN THE RESTRICTED BANDS	
	7.6.1	E.U.T. Operation	
	7.6.2 7.6.3	Test Setup Diagram Measurement Procedure and Data	
		RADIATED SPURIOUS EMISSIONS	
	7.7.1	E.U.T. Operation	
	7.7.2	Test Setup Diagram	
		. •	

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Report No.: SZEM180300235701

Page: 5 of 51

7	7.7.3 Measurement Procedure and Data	26
8 P	PHOTOGRAPHS	35
8.1	RADIATED EMISSIONS WHICH FALL IN THE RESTRICTED BANDS TEST SETUP	35
8.2		
8.3	EUT CONSTRUCTIONAL DETAILS (EUT PHOTOS)	36
9 A	APPENDIX	37
9.1	Appendix 15.247	37-51



Report No.: SZEM180300235701

Page: 6 of 51

4 General Information

4.1 Details of E.U.T.

Power supply:	Button cell: 2*1.5V
Antenna Gain	0dBi
Antenna Type	Monopole
Channel Spacing	2MHz
Modulation Type	GFSK
Bluetooth Version:	V4.0 BT Signal mode
Number of Channels	40
Operation Frequency	2402MHz to 2480MHz

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

Selected Test Channel				
Channel	Frequency			
The lowest channel (CH0)	2402MHz			
The middle channel (CH19)	2440MHz			
The highest channel (CH39)	2480MHz			

4.2 Description of Support Units

The EUT has been tested as an independent unit.



Report No.: SZEM180300235701

Page: 7 of 51

4.3 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	7.25 x 10 ⁻⁸
2	Duty cycle	0.37%
3	Occupied Bandwidth	3%
4	RF conducted power	0.75dB
5	RF power density	2.84dB
6	Conducted Spurious emissions	0.75dB
7	DE Dadiated news	4.5dB (below 1GHz)
/	RF Radiated power	4.8dB (above 1GHz)
0	Dedicted Courses ancies on test	4.5dB (Below 1GHz)
8	Radiated Spurious emission test	4.8dB (Above 1GHz)
9	Temperature test	1 ℃
10	Humidity test	3%
11	Supply voltages	1.5%
12	Time	3%



Report No.: SZEM180300235701

Page: 8 of 51

4.4 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch

No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China. 518057.

Tel: +86 755 2601 2053 Fax: +86 755 2671 0594

No tests were sub-contracted.

4.5 Test Facility

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

· CNAS (No. CNAS L2929)

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC

Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

A2LA (Certificate No. 3816.01)

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

VCCI

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

• FCC -Designation Number: CN1178

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

Industry Canada (IC)

Two 3m Semi-anechoic chambers and the 10m Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1, 4620C-2, 4620C-3.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None



Report No.: SZEM180300235701

Page: 9 of 51

5 Equipment List

Minimum 6dB Bandwidth							
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date		
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2017-09-27	2018-09-26		
Spectrum Analyzer	Rohde & Schwarz	FSU43	SEM004-08	2018-04-02	2019-04-01		
Measurement Software	JS Tonscend	JS1120-2 BT/WIFI V2.	N/A	N/A	N/A		
Coaxial Cable	SGS	N/A	SEM031-01	2017-07-13	2018-07-12		
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A		
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2017-09-27	2018-09-26		
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2017-09-27	2018-09-26		

Conducted Peak Output Power							
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date		
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2017-09-27	2018-09-26		
Spectrum Analyzer	Rohde & Schwarz	FSU43	SEM004-08	2018-04-02	2019-04-01		
Measurement Software	JS Tonscend	JS1120-2 BT/WIFI V2.	N/A	N/A	N/A		
Coaxial Cable	SGS	N/A	SEM031-01	2017-07-13	2018-07-12		
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A		
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2017-09-27	2018-09-26		
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2017-09-27	2018-09-26		

Power Spectrum Density								
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date			
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2017-09-27	2018-09-26			
Spectrum Analyzer	Rohde & Schwarz	Schwarz FSU43 SEM004-08		2018-04-02	2019-04-01			
Measurement Software	JS Tonscend	nscend JS1120-2 BT/WIFI V2. N/A		N/A	N/A			
Coaxial Cable	SGS	N/A SEM031-01		2017-07-13	2018-07-12			
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A			
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2017-09-27	2018-09-26			
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2017-09-27	2018-09-26			

Conducted Band Edges Measurement									
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date				
DC Power Supply	ZhaoXin	ZhaoXin RXN-305D SEM011-02		2017-09-27	2018-09-26				
Spectrum Analyzer	Rohde & Schwarz	& Schwarz FSU43 SEM004-08		2018-04-02	2019-04-01				
Measurement Software	JS Tonscend	Tonscend JS1120-2 BT/WIFI V2. N/A		N/A	N/A				
Coaxial Cable	SGS	SGS N/A SEM		2017-07-13	2018-07-12				
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A				
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2017-09-27	2018-09-26				

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Report No.: SZEM180300235701

Page: 10 of 51

Conducted Spurious Emissions									
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date				
DC Power Supply	ZhaoXin	ZhaoXin RXN-305D SEM011-02		2017-09-27	2018-09-26				
Spectrum Analyzer	Rohde & Schwarz	varz FSU43 SEM004-08		2018-04-02	2019-04-01				
Measurement Software	JS Tonscend	onscend JS1120-2 BT/WIFI V2. N/A		N/A	N/A				
Coaxial Cable	SGS	N/A	SEM031-01	2017-07-13	2018-07-12				
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A				
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2017-09-27	2018-09-26				
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2017-09-27	2018-09-26				

RE in Chamber					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
3m Semi-Anechoic Chamber	AUDIX	DIX N/A SEM001-02		2018-03-13	2021-03-12
Measurement Software	AUDIX	AUDIX e3 V8.2014-6- 27 N/A		N/A	N/A
Coaxial Cable	SGS	N/A	SEM026-01	2017-07-13	2018-07-12
Spectrum Analyzer	Rohde & Schwarz	FSU43	SEM004-08	2018-04-02	2019-04-01
BiConiLog Antenna (26- 3000MHz)	ETS-Lindgren	3142C	SEM003-01	2017-06-27	2020-06-26
Horn Antenna (1- 18GHz)	Rohde & Schwarz	Schwarz HF907 SEM003-07		2018-04-13	2021-04-12
Horn Antenna(15GHz- 40GHz)	· I Schwarzhock I BBHA UI/II I S		SEM003-15	2017-10-17	2020-10-16
Pre-amplifier (0.1- 1300MHz)	HP	8447D	SEM005-02	2017-09-27	2018-09-26
Low Noise Amplifier(100MHz- 18GHz)	Low Noise Black Diamond BDLNA Sories 352		SEM005-05	2017-09-27	2018-09-27
Pre-amplifier(18-26GHz)	Rohde & Schwarz	CH14-H052	SEM005-17	2018-04-02	2019-04-01
Pre-amplifier(26GHz- 40GHz)	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2018-04-02	2019-04-01
DC Power Supply	Zhao Xin	RXN-305D	SEM011-02	2017-09-27	2018-09-26
Active Loop Antenna	ETS-Lindgren	6502	SEM003-08	2017-08-22	2020-08-21
Band filter	N/A	N/A	SEM023-01	N/A	N/A



Report No.: SZEM180300235701

Page: 11 of 51

	RE in Chamber					
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. Date (yyyy-mm-dd)	Cal. Due date (yyyy-mm-dd)
1	3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEM001-01	2017-08-05	2020-08-04
2	MXE EMI Receiver (20Hz-8.4GHz)	Agilent Technologies	N9038A	SEM004-05	2017-09-27	2018-09-26
3	BiConiLog Antenna (26-3000MHz)	ETS-LINDGREN	3142C	SEM003-01	2017-06-27	2020-06-26
4	Pre-amplifier (0.1-1300MHz)	Agilent Technologies	8447D	SEM005-01	2018-04-02	2019-04-01
5	Measurement Software	AUDIX	e3 V8.2014-6- 27	N/A	N/A	N/A
6	Coaxial Cable	SGS	N/A	SEM025-01	2017-07-13	2018-07-12

General used equipment								
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date			
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-03	2017-09-29	2018-09-28			
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-04	2017-09-29	2018-09-28			
Humidity/ Temperature Indicator			SEM002-08	2017-09-29	2018-09-28			
Barometer	Changchun Meteorological Industry Factory	DYM3	SEM002-01	2018-04-08	2019-04-07			



Report No.: SZEM180300235701

Page: 12 of 51

6 Radio Spectrum Technical Requirement

6.1 Antenna Requirement

6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203 & 15.247(c)

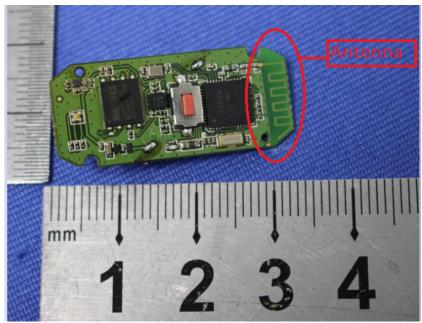
6.1.2 Conclusion

Standard Requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.247(b) (4) requirement:

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.



EUT Antenna:

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 0dBi.



Report No.: SZEM180300235701

Page: 13 of 51

7 Radio Spectrum Matter Test Results

7.1 Minimum 6dB Bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.247a(2)
Test Method: ANSI C63.10 (2013) Section 11.8.1

Limit: ≥500 kHz

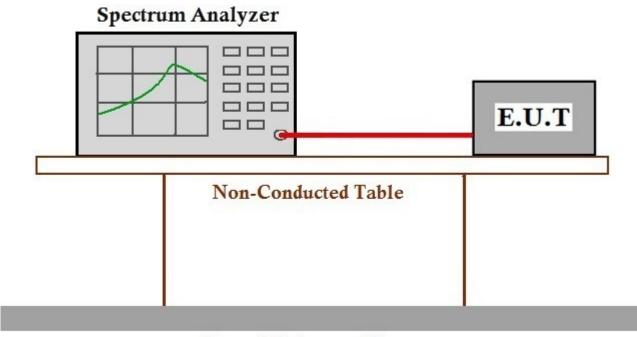
7.1.1 E.U.T. Operation

Operating Environment:

Temperature: 22.3 °C Humidity: 56.5 % RH Atmospheric Pressure: 1020 mbar

Test mode a:TX mode_Keep the EUT in continuously transmitting mode.

7.1.2 Test Setup Diagram



Ground Reference Plane

7.1.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247



Report No.: SZEM180300235701

Page: 14 of 51

7.2 Conducted Peak Output Power

Test Requirement 47 CFR Part 15, Subpart C 15.247(b)(3)
Test Method: ANSI C63.10 (2013) Section 11.9.1

Limit:

Frequency range(MHz)	Output power of the intentional radiator(watt)					
	1 for ≥50 hopping channels					
902-928	0.25 for 25≤ hopping channels <50					
	1 for digital modulation					
	1 for ≥75 non-overlapping hopping channels					
2400-2483.5	0.125 for all other frequency hopping systems					
	1 for digital modulation					
5725-5850	1 for frequency hopping systems and digital modulation					

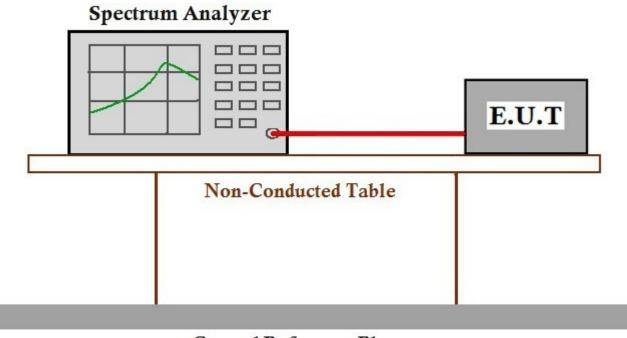
7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 22.3 °C Humidity: 56.5 % RH Atmospheric Pressure: 1020 mbar

Test mode a:TX mode_Keep the EUT in continuously transmitting mode.

7.2.2 Test Setup Diagram



Ground Reference Plane

7.2.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

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Report No.: SZEM180300235701

Page: 15 of 51

7.3 Power Spectrum Density

Test Requirement 47 CFR Part 15, Subpart C 15.247(e)
Test Method: ANSI C63.10 (2013) Section 11.10.2

Limit: ≤8dBm in any 3 kHz band during any time interval of continuous

transmission

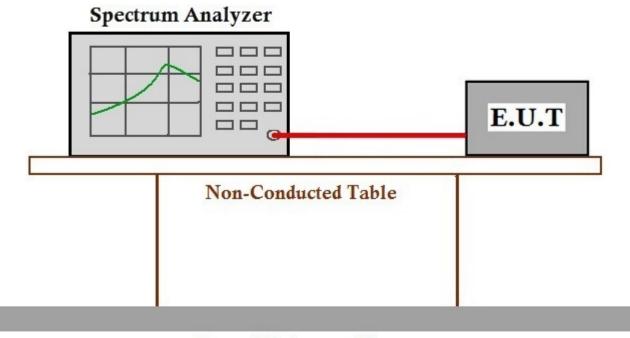
7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 22.3 °C Humidity: 56.6 % RH Atmospheric Pressure: 1020 mbar

Test mode a:TX mode Keep the EUT in continuously transmitting mode.

7.3.2 Test Setup Diagram



Ground Reference Plane

7.3.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247



Report No.: SZEM180300235701

Page: 16 of 51

7.4 Conducted Band Edges Measurement

Test Requirement 47 CFR Part 15, Subpart C 15.247(d)
Test Method: ANSI C63.10 (2013) Section 11.13.3.2

Limit: In any 100 kHz bandwidth outside the

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)

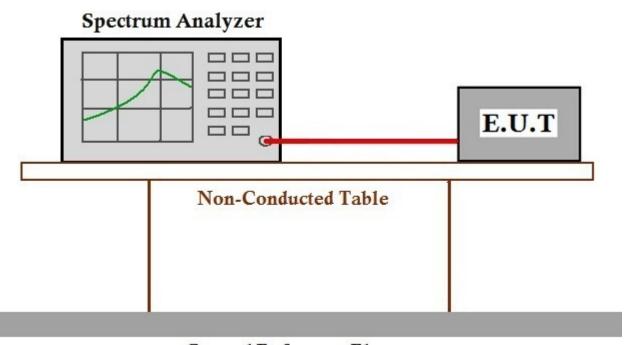
7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 22.3 °C Humidity: 56.7 % RH Atmospheric Pressure: 1020 mbar

Test mode a:TX mode_Keep the EUT in continuously transmitting mode.

7.4.2 Test Setup Diagram



Ground Reference Plane

7.4.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

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Report No.: SZEM180300235701

Page: 17 of 51

7.5 Conducted Spurious Emissions

Test Requirement 47 CFR Part 15, Subpart C 15.247(d)
Test Method: ANSI C63.10 (2013) Section 11.11

Limit: 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)

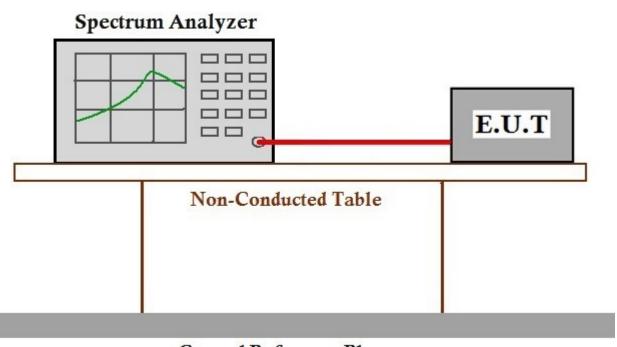
7.5.1 E.U.T. Operation

Operating Environment:

Temperature: 22.3 °C Humidity: 56.6 % RH Atmospheric Pressure: 1020 mbar

Test mode a:TX mode Keep the EUT in continuously transmitting mode.

7.5.2 Test Setup Diagram



Ground Reference Plane

7.5.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

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Report No.: SZEM180300235701

Page: 18 of 51

7.6 Radiated Emissions which fall in the restricted bands

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209

Test Method: ANSI C63.10 (2013) Section 6.10.5

Measurement Distance: 3m

Limit:

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

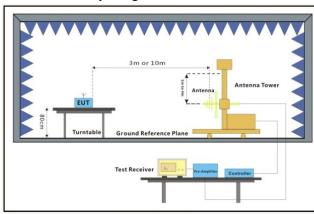
7.6.1 E.U.T. Operation

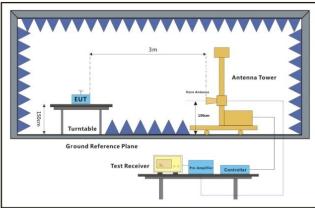
Operating Environment:

Temperature: 20.2 °C Humidity: 50 % RH Atmospheric Pressure: 1020 mbar

Test mode a:TX mode_Keep the EUT in continuously transmitting mode.

7.6.2 Test Setup Diagram





30MHz-1GHz Above 1GHz



Report No.: SZEM180300235701

Page: 19 of 51

7.6.3 Measurement Procedure and Data

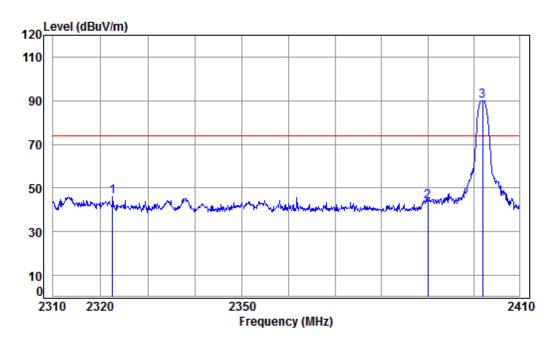
- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- h. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j. Repeat above procedures until all frequencies measured was complete.
- Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor
- Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.



Report No.: SZEM180300235701

Page: 20 of 51

Mode:a; Polarization:Horizontal; Modulation:GFSK; Channel:Low



Condition: 3m HORIZONTAL

Job No : 02357CR

Mode : 2402 Band edge

Note : BT

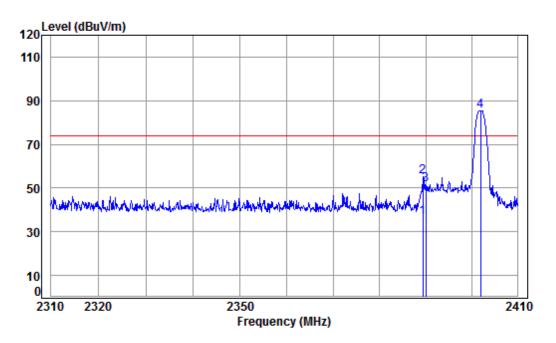
			Cable	Ant	Preamp	Read		Limit	0ver	
		Frea	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
		•								
	_	MII-				4D. W	JD. 3//	JD. 377-		
		MHZ	ав	ab/m	dB	abuv	abuv/m	abuv/m	dB	
1	2	2322.565	5.38	28.87	41.84	53.56	45.97	74.00	-28.03	peak
2	2	2390.000	5.47	29.08	41.87	51.10	43.78	74.00	-30.22	peak
										•
3	pp 2	2402.000	5.49	29.11	41.00	97.32	90.04	74.00	16.04	peak



Report No.: SZEM180300235701

Page: 21 of 51

Mode:a; Polarization:Vertical; Modulation:GFSK; Channel:Low



Condition: 3m VERTICAL Job No : 02357CR

Mode : 2402 Band edge

Note : BT

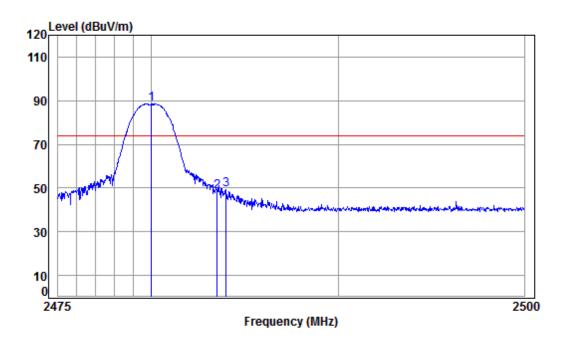
Cable Ant Preamp Read Limit 0ver Freq Loss Factor Factor Level Level Line Limit Remark MHz dBuV dBuV/m dBuV/m dB dB dB/m dΒ 1 av 2389.356 5.47 29.08 41.87 43.65 36.33 54.00 -17.67 Average 2389.356 5.47 29.08 41.87 62.48 55.16 74.00 -18.84 peak 3 2390.000 5.47 29.08 41.87 58.97 51.65 74.00 -22.35 peak 29.11 41.88 92.67 85.39 74.00 11.39 peak 4 pp 2402.000 5.49



Report No.: SZEM180300235701

Page: 22 of 51

Mode:a; Polarization:Horizontal; Modulation:GFSK; Channel:High



Condition: 3m HORIZONTAL

Job No : 02357CR

Mode : 2480 Band edge

Note : BT

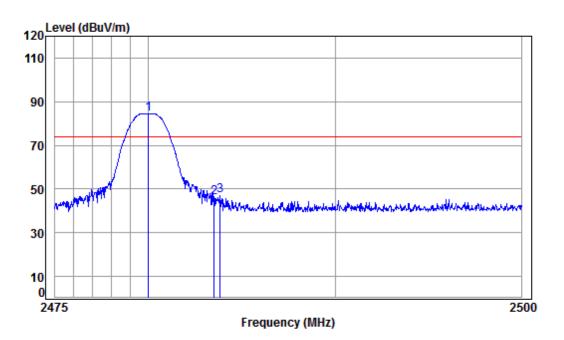
		Cable	Ant	Preamp	Read		Limit	0ver	
	Freq			Factor					Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1 pp	2480.000	5.59	29.34	41.91	95.34	88.36	74.00	14.36	peak
2	2483.500	5.60	29.35	41.91	55.35	48.39	74.00	-25.61	peak
3	2483.996	5.60	29.35	41.91	56.36	49.40	74.00	-24.60	peak



Report No.: SZEM180300235701

Page: 23 of 51

Mode:a; Polarization:Vertical; Modulation:GFSK; Channel:High



Condition: 3m VERTICAL Job No : 02357CR

Mode : 2480 Band edge

Note : BT

	Freq			Preamp Factor					Remark	
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB		
2	2480.000 2483.500 2483.821	5.60	29.35	41.91	53.01	46.05	74.00	-27.95	peak	



Report No.: SZEM180300235701

Page: 24 of 51

7.7 Radiated Spurious Emissions

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209
Test Method: ANSI C63.10 (2013) Section 6.4,6.5,6.6

Detector: Below 1GHz: QP

Above 1GHz:AV

Measurement Distance: 3m

Limit:

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

7.7.1 E.U.T. Operation

Operating Environment:

Temperature: 20.2 °C Humidity: 49.8 % RH Atmospheric Pressure: 1020 mbar

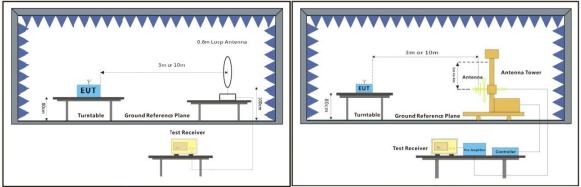
Test mode a:TX mode_Keep the EUT in continuously transmitting mode.



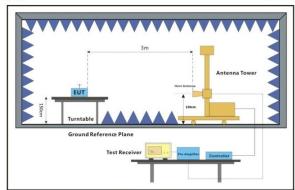
Report No.: SZEM180300235701

Page: 25 of 51

7.7.2 Test Setup Diagram



Below 30MHz 30MHz-1GHz



Above 1GHz



Report No.: SZEM180300235701

Page: 26 of 51

7.7.3 Measurement Procedure and Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

- b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- h. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j. Repeat above procedures until all frequencies measured was complete.

Remark:

- 1) For emission below 1GHz, through pre-scan found the worst case is the lowest channel. Only the worst case is recorded in the report.
- 2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level =Receiver Reading + Antenna Factor + Cable Factor - Preamplifier Factor

- 3) Scan from 9kHz to 25GHz, the disturbance above 18GHz and below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.
- 4) For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

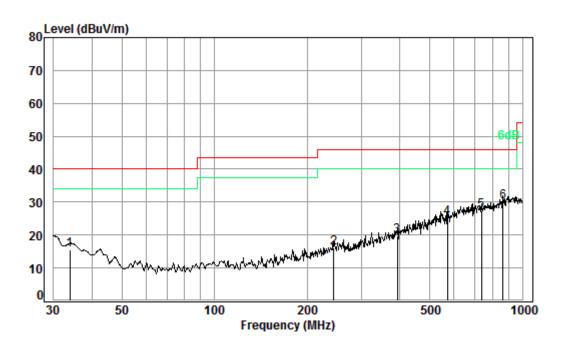


Report No.: SZEM180300235701

Page: 27 of 51

Radiated emission below 1GHz

Mode:a; Polarization:Horizontal



Condition: 3m HORIZONTAL

Job No. : 02357CR

Test mode: a

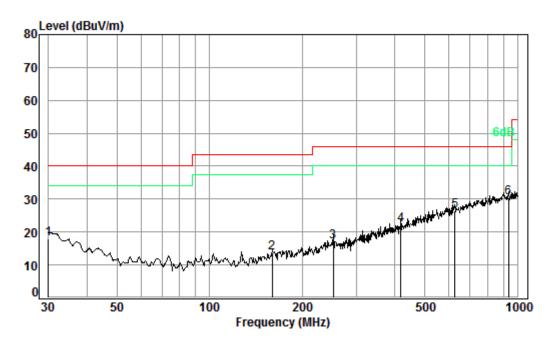
	Freq			Preamp Factor				Over Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	33.92	0.60	20.37	27.65	22.19	15.51	40.00	-24.49
2	244.23	1.65	18.87	27.53	23.08	16.07	46.00	-29.93
3	392.10	2.18	22.21	27.72	23.14	19.81	46.00	-26.19
4	570.61	2.67	26.05	27.75	24.35	25.32	46.00	-20.68
5	737.07	3.02	28.13	27.50	23.81	27.46	46.00	-18.54
6 рр	866.09	3.47	29.38	27.19	24.33	29.99	46.00	-16.01



Report No.: SZEM180300235701

Page: 28 of 51

Mode:a; Polarization:Vertical;



Condition: 3m VERTICAL Job No. : 02357CR

Test mode: a

	Freq			Preamp Factor				Over Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	30.00	0.60	22.50	27.67	22.48	17.91	40.00	-22.09
2	159.78	1.34	15.48	27.52	24.48	13.78	43.50	-29.72
3	252.06	1.68	18.98	27.54	24.01	17.13	46.00	-28.87
4	417.64	2.28	22.83	27.76	24.83	22.18	46.00	-23.82
5	627.27	2.76	26.97	27.66	24.31	26.38	46.00	-19.62
6 рр	935.55	3.64	29.98	26.96	23.62	30.28	46.00	-15.72

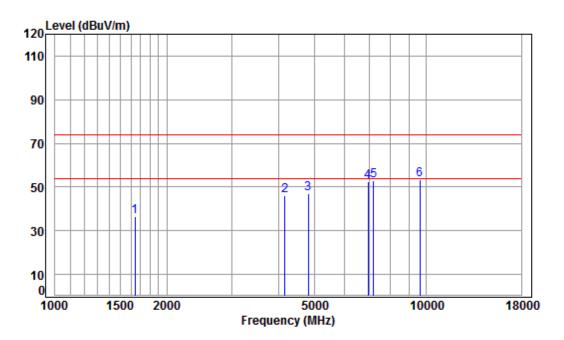


Report No.: SZEM180300235701

Page: 29 of 51

Transmitter emission above 1GHz

Mode:a; Polarization:Horizontal; Modulation:GFSK; ; Channel:Low



Condition: 3m HORIZONTAL

Job No : 02357CR

Mode : 2402 TX RSE

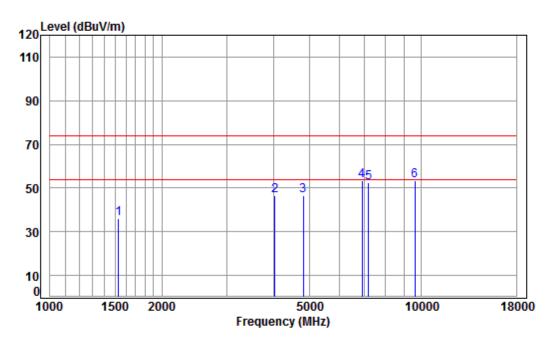
		Cable	Ant	Preamp	Read		Limit	0ver	
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1644.019	5.30	26.44	41.50	46.39	36.63	74.00	-37.37	peak
2	4157.664	7.17	33.60	42.36	47.75	46.16	74.00	-27.84	peak
3	4804.000	7.89	34.16	42.47	47.24	46.82	74.00	-27.18	peak
4	6954.852	10.25	36.38	40.89	46.65	52.39	74.00	-21.61	peak
5	7206.000	10.08	36.42	40.71	47.19	52.98	74.00	-21.02	peak
6	pp 9608.000	10.75	37.52	37.74	42.70	53.23	74.00	-20.77	peak



Report No.: SZEM180300235701

Page: 30 of 51

Mode:a; Polarization:Vertical; Modulation:GFSK; ; Channel:Low



Condition: 3m VERTICAL

Job No : 02357CR

Mode : 2402 TX RSE

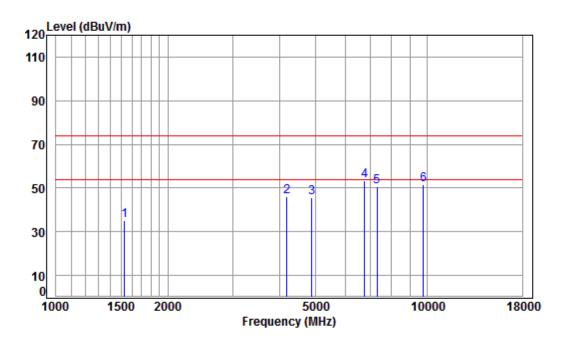
		Cable	Ant	Preamp	Read		Limit	0ver	
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1529.414	5.44	25.94	41.43	46.17	36.12	74.00	-37.88	peak
2	4027.554	7.01	33.60	42.33	48.17	46.45	74.00	-27.55	peak
3	4804.000	7.89	34.16	42.47	47.16	46.74	74.00	-27.26	peak
4	6914.763	10.36	36.27	40.91	47.48	53.20	74.00	-20.80	peak
5	7206.000	10.08	36.42	40.71	46.56	52.35	74.00	-21.65	peak
6	op 9608.000	10.75	37.52	37.74	42.97	53.50	74.00	-20.50	peak



Report No.: SZEM180300235701

Page: 31 of 51

Mode:a; Polarization:Horizontal; Modulation:GFSK; ; Channel:middle



Condition: 3m HORIZONTAL

Job No : 02357CR

Mode : 2440 TX RSE

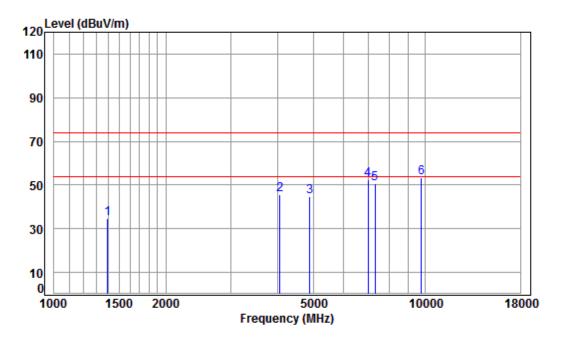
ote	: DLC								
		Cable	Ant	Preamp	Read		Limit	0ver	
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1529.414	5.44	25.94	41.43	45.32	35.27	74.00	-38.73	peak
2	4181.768	7.20	33.60	42.36	47.65	46.09	74.00	-27.91	peak
3	4880.000	7.97	34.29	42.48	45.85	45.63	74.00	-28.37	peak
4 pp	6776.265	10.75	35.89	41.01	47.57	53.20	74.00	-20.80	peak
5	7320.000	10.05	36.37	40.63	45.00	50.79	74.00	-23.21	peak
6	9760 000	10.82	37.55	37.53	40 88	51.72	74 00	-22.28	neak



Report No.: SZEM180300235701

Page: 32 of 51

Mode:a; Polarization:Vertical; Modulation:GFSK; ; Channel:middle



Condition: 3m VERTICAL

Job No : 02357CR

Mode : 2440 TX RSE

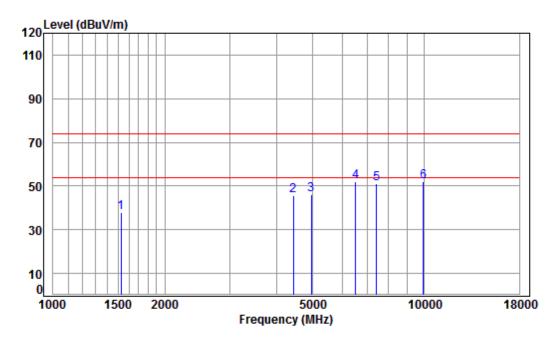
		Cable	Ant	Preamp	Read		Limit	0ver	
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1394.300	5.13	25.37	41.33	45.52	34.69	74.00	-39.31	peak
2	4062.629	7.06	33.60	42.34	47.38	45.70	74.00	-28.30	peak
3	4880.000	7.97	34.29	42.48	44.99	44.77	74.00	-29.23	peak
4	6995.172	10.14	36.49	40.86	46.79	52.56	74.00	-21.44	peak
5	7320.000	10.05	36.37	40.63	44.67	50.46	74.00	-23.54	peak
6	pp 9760.000	10.82	37.55	37.53	42.46	53.30	74.00	-20.70	peak



Report No.: SZEM180300235701

Page: 33 of 51

Mode:a; Polarization:Horizontal; Modulation:GFSK; ; Channel:High



Condition: 3m HORIZONTAL

Job No : 02357CR

Mode : 2480 TX RSE

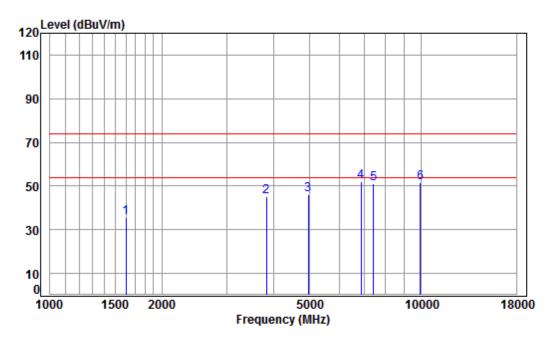
			Cable	Ant	Preamp	Read		Limit	0ver	
		Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
		MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1		1525.000	5.45	25.91	41.42	48.15	38.09	74.00	-35.91	peak
2		4443.453	7.50	33.60	42.41	46.75	45.44	74.00	-28.56	peak
3		4960.000	8.05	34.43	42.49	46.02	46.01	74.00	-27.99	peak
4		6526.373	11.46	35.18	41.20	46.67	52.11	74.00	-21.89	peak
5		7440.000	10.02	36.32	40.56	45.30	51.08	74.00	-22.92	peak
6	pp	9920.000	10.90	37.58	37.31	40.97	52.14	74.00	-21.86	peak



Report No.: SZEM180300235701

Page: 34 of 51

Mode:a; Polarization:Vertical; Modulation:GFSK; ; Channel:High



Condition: 3m VERTICAL

Job No : 02357CR

Mode : 2480 TX RSE

		Cable	Ant	Preamp	Read		Limit	0ver	
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1601.804	5.35	26.26	41.47	45.54	35.68	74.00	-38.32	peak
2	3823.371	6.80	33.13	42.29	47.38	45.02	74.00	-28.98	peak
3	4960.000	8.05	34.43	42.49	46.16	46.15	74.00	-27.85	peak
4 pp	6874.906	10.47	36.16	40.94	46.37	52.06	74.00	-21.94	peak
5	7440.000	10.02	36.32	40.56	45.18	50.96	74.00	-23.04	peak
6	9920.000	10.90	37.58	37.31	40.45	51.62	74.00	-22.38	peak



Report No.: SZEM180300235701

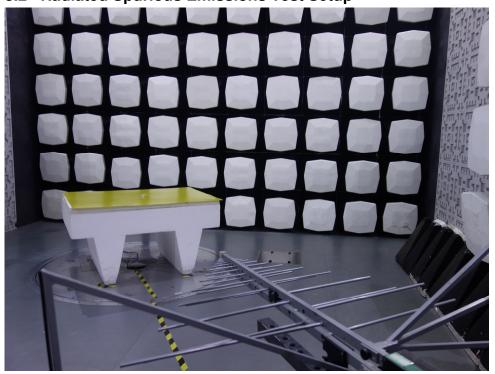
Page: 35 of 51

8 Photographs

8.1 Radiated Emissions which fall in the restricted bands Test Setup



8.2 Radiated Spurious Emissions Test Setup



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Report No.: SZEM180300235701

Page: 36 of 51



8.3 EUT Constructional Details (EUT Photos)

Refer to EUT external and internal photos.



Report No.: SZEM180300235701

Page: 37 of 51

9 Appendix

9.1 Appendix 15.247

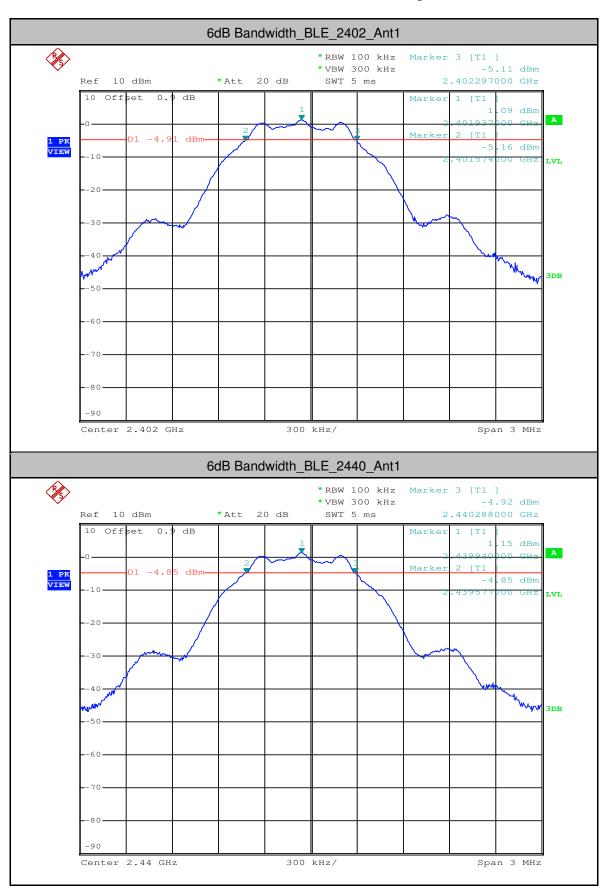
1.6dB Bandwidth

Test Mode	Test	Ant	EBW[MHz]	Limit[MHz]	Verdict
BLE	2402	Ant1	0.723	>=0.5	PASS
BLE	2440	Ant1	0.711	>=0.5	PASS
BLE	2480	Ant1	0.705	>=0.5	PASS



Report No.: SZEM180300235701

Page: 38 of 51

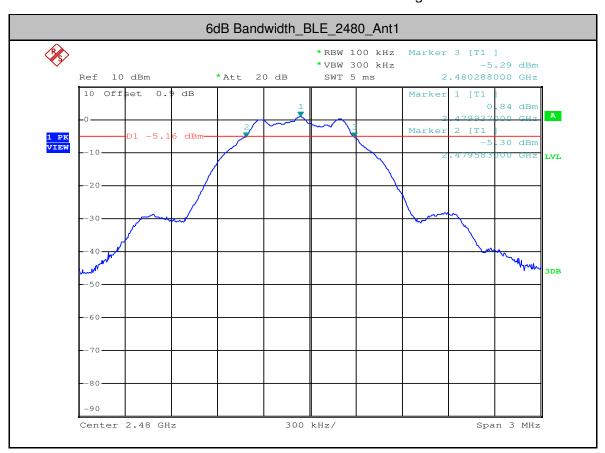


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Report No.: SZEM180300235701

Page: 39 of 51



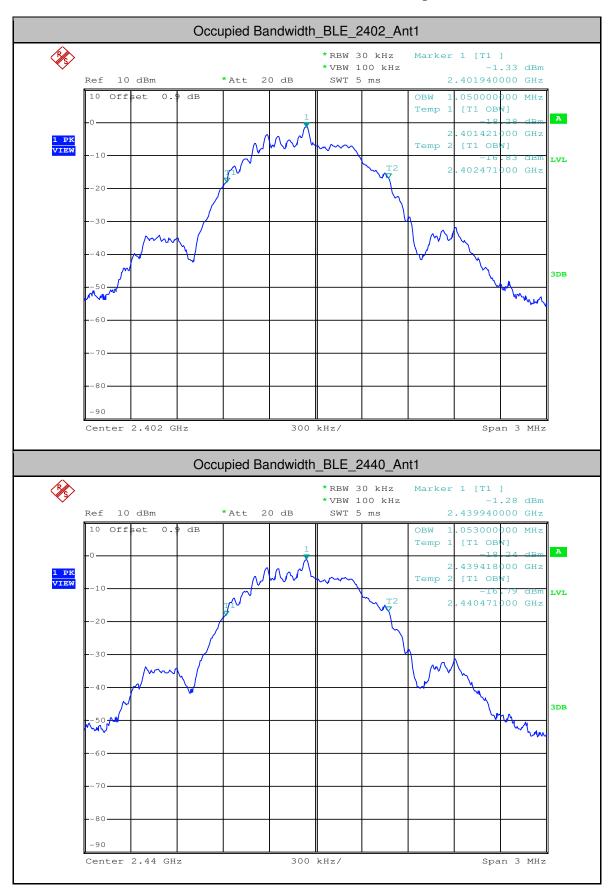
2.Occupied Bandwidth

Test Mode	Test Channel	Ant	OBW[MHz]	Limit[MHz]	Verdict
BLE	2402	Ant1	1.050		PASS
BLE	2440	Ant1	1.053		PASS
BLE	2480	Ant1	1.056		PASS



Report No.: SZEM180300235701

Page: 40 of 51



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Report No.: SZEM180300235701

Page: 41 of 51



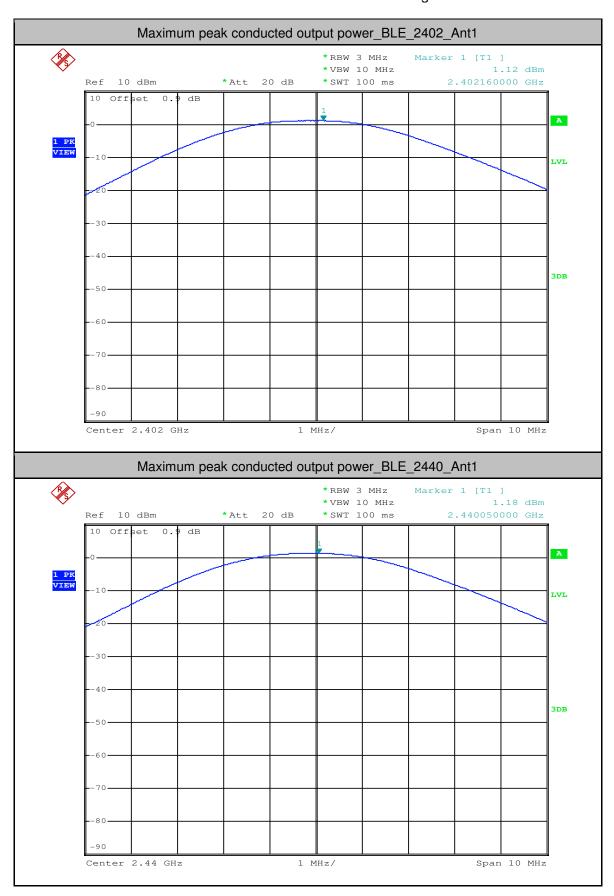
3.Maximum peak conducted output power

Test Mode	Test Channel	Ant	Power[dBm]	Limit[dBm]	Verdict
BLE	2402	Ant1	1.12	<30	PASS
BLE	2440	Ant1	1.18	<30	PASS
BLE	2480	Ant1	0.87	<30	PASS



Report No.: SZEM180300235701

Page: 42 of 51



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Report No.: SZEM180300235701

Page: 43 of 51



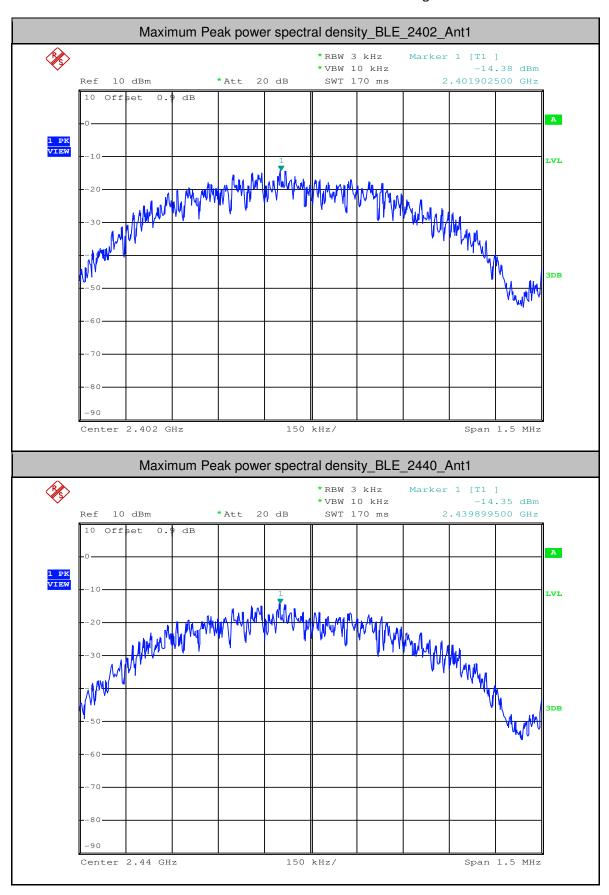
4. Maximum Peak power spectral density

Test Mode	Test Channel	Ant	PSD[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE	2402	Ant1	-14.38	<8.00	PASS
BLE	2440	Ant1	-14.35	<8.00	PASS
BLE	2480	Ant1	-14.7	<8.00	PASS



Report No.: SZEM180300235701

Page: 44 of 51



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Report No.: SZEM180300235701

Page: 45 of 51



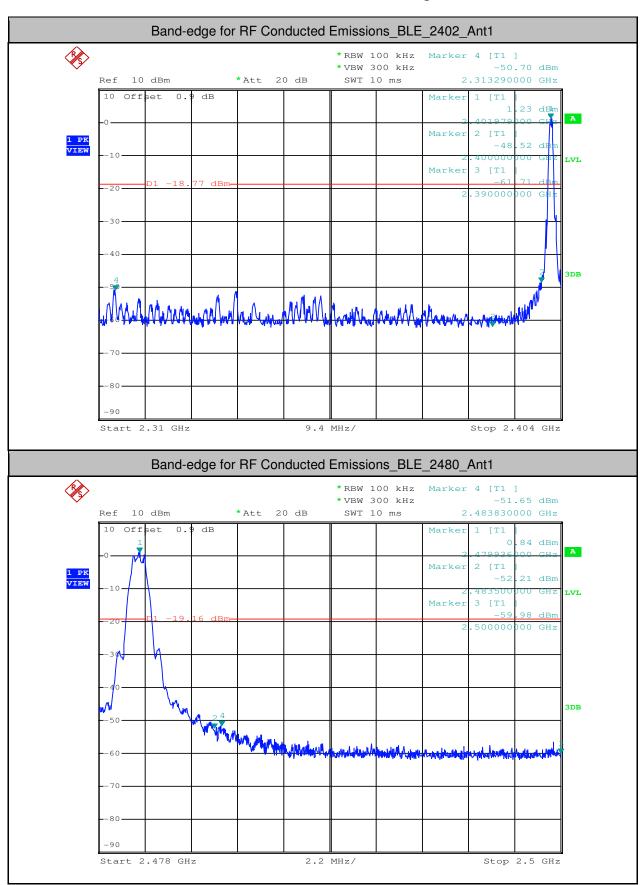
5.Band-edge for RF Conducted Emissions

Test Mode	Test Channel	Ant	Carrier Power[dBm]	Max. Spurious Level [dBm]	Limit [dBm]	Verdict
BLE	2402	Ant1	1.230	-50.705	<-18.77	PASS
BLE	2480	Ant1	0.840	-51.654	<-19.16	PASS



Report No.: SZEM180300235701

Page: 46 of 51



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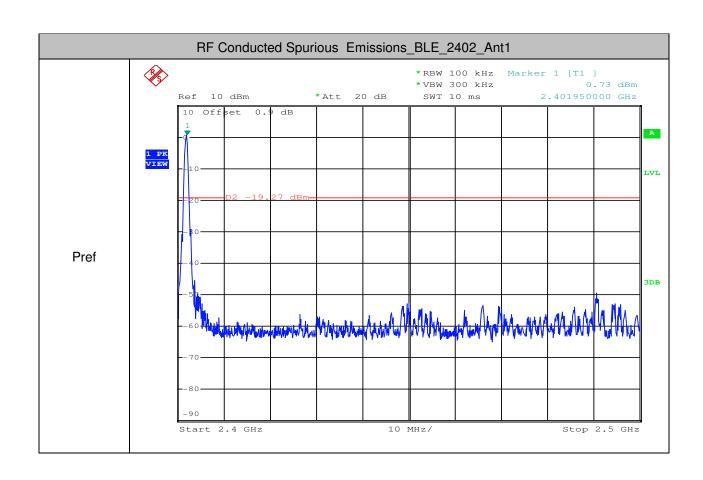


Report No.: SZEM180300235701

Page: 47 of 51

6.RF Conducted Spurious Emissions

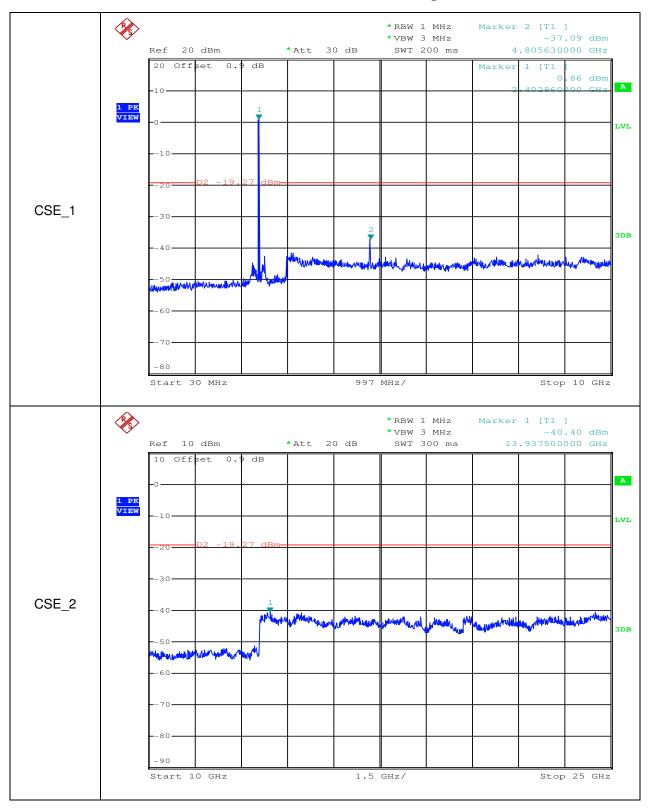
Test Mode	Test Channel	StartFre [MHz]	StopFre [MHz]	RBW [kHz]	VBW [kHz]	Pref[dBm]	Max. Level [dBm]	Limit [dBm]	Verdict
BLE	2402	30	10000	1000	3000	0.73	-37.090	<-19.27	PASS
BLE	2402	10000	25000	1000	3000	0.73	-40.400	<-19.27	PASS
BLE	2440	30	10000	1000	3000	1.36	-39.180	<-18.64	PASS
BLE	2440	10000	25000	1000	3000	1.36	-40.110	<-18.64	PASS
BLE	2480	30	10000	1000	3000	0.8	-39.130	<-19.2	PASS
BLE	2480	10000	25000	1000	3000	0.8	-40.150	<-19.2	PASS





Report No.: SZEM180300235701

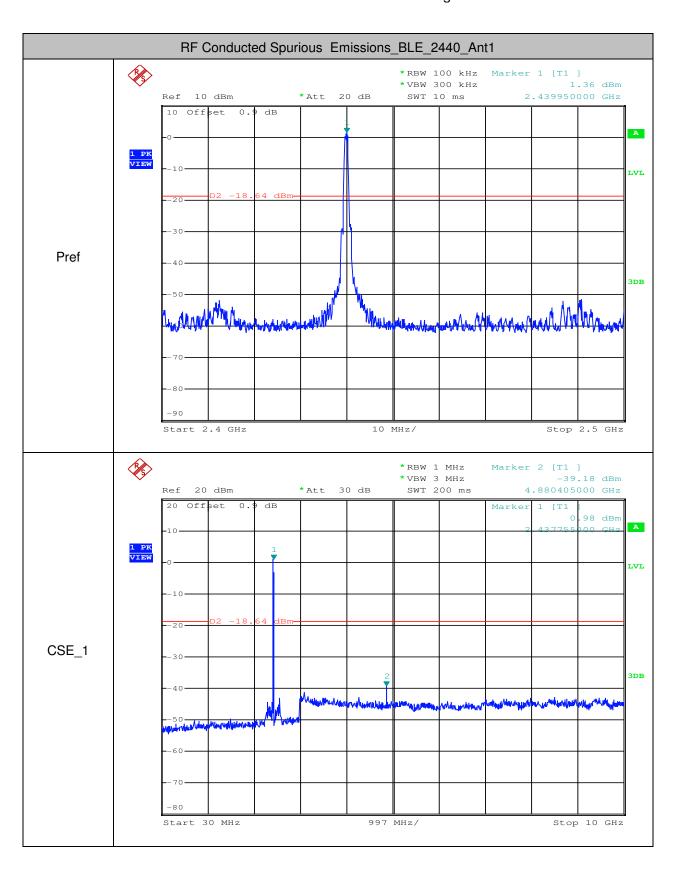
Page: 48 of 51





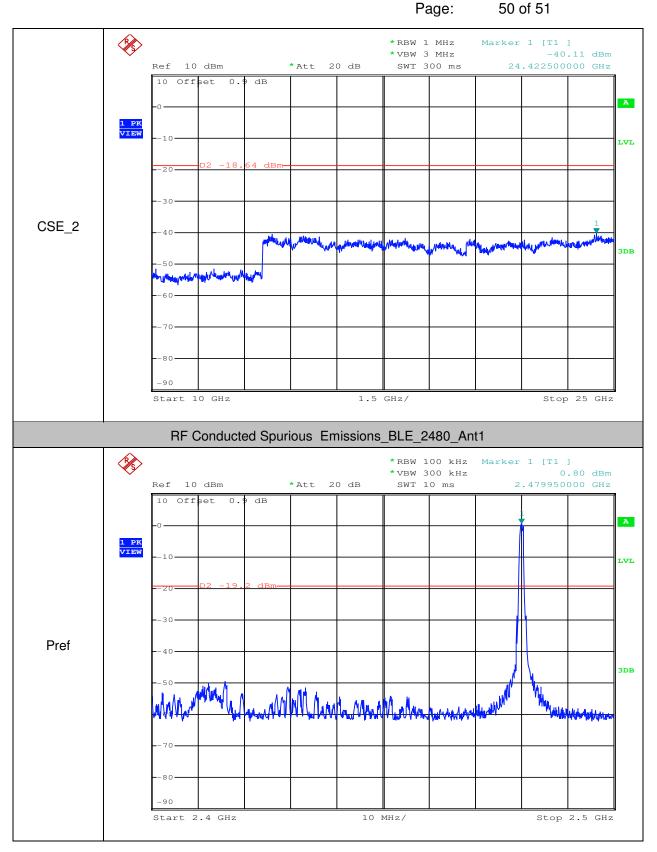
Report No.: SZEM180300235701

Page: 49 of 51





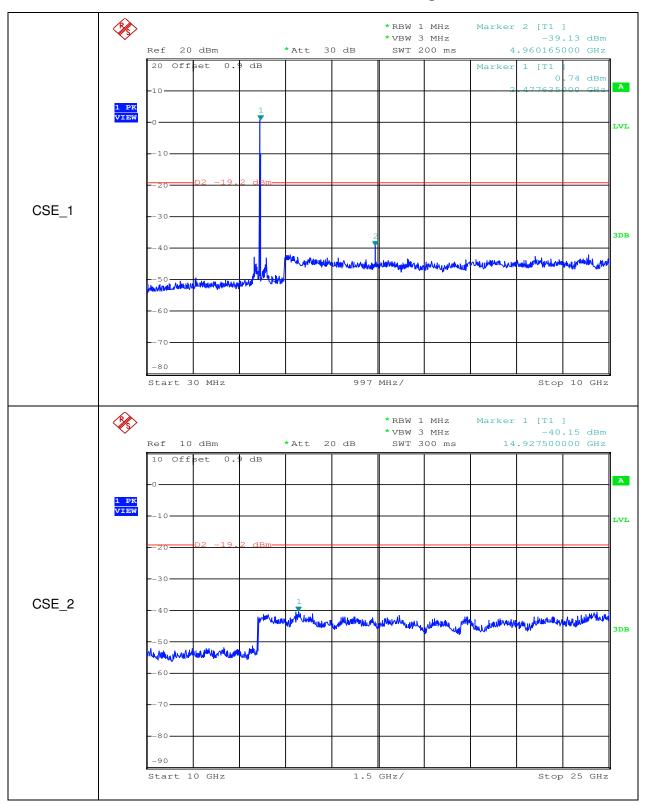
Report No.: SZEM180300235701





Report No.: SZEM180300235701

Page: 51 of 51



- End of the Report -