

Report No.: SZEM200900995402

Page: 1 of 47

TEST REPORT

Application No.: SZEM2009009954CR
Applicant: Shenzhen Gotron Electronic CO., LTD.
Address of Applicant: 518, 5F, R&D building, Tsinghua Hi-Tech park, Nanshan district, Shenzhen 518057 P.R. China
Manufacturer: Shenzhen Gotron Electronic CO., LTD.
Address of Manufacturer: 518, 5F, R&D building, Tsinghua Hi-Tech park, Nanshan district, Shenzhen 518057 P.R. China
Equipment Under Test (EUT):
EUT Name: Smart Sports Watch
Model No.: Ulefone Watch
Trade mark: ulefone
Standard(s) : EN 300 328 V2.1.1
Date of Receipt: 2019-08-13 (for original report SZEM190801743702)
Date of Test: 2019-08-14 to 2019-08-17 (for original report SZEM190801743702)
Date of Issue: 2019-08-26 (for original report SZEM190801743702)
2020-10-09 (for new report SZEM200900995402)

Test Result:	Pass*
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* In the configuration tested, the EUT complied with the standards specified above.

The CE mark as shown below can be used, under the responsibility of the manufacturer, after completion of an EU Declaration of Conformity and compliance with all relevant EU Directives.

Keny Xu

Keny Xu
EMC Laboratory Manager



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Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2020-10-09		Original

Authorized for issue by:			
			
		Bill Chen /Project Engineer	
			
		Eric Fu /Reviewer	

2 Test Summary

Radio Spectrum Technical Requirement				
Item	Standard	Method	Requirement	Result
Geo-location capability	EN 300 328 V2.1.1	EN 300 328 V2.1.1	EN 300 328 Clause 4.3.2.12	Customer Declaration

Radio Spectrum Matter Part				
Item	Standard	Method	Requirement	Result
RF Output Power	EN 300 328 V2.1.1	EN 300 328 V2.1.1 clause 5.4.2.2.1.2	EN 300 328 Clause 4.3.2.2	Pass
Power Spectral Density	EN 300 328 V2.1.1	EN 300 328 V2.1.1 clause 5.4.3.2.1	EN 300 328 Clause 4.3.2.3	Pass
Occupied Channel Bandwidth	EN 300 328 V2.1.1	EN 300 328 V2.1.1 clause 5.4.7.2.1	EN 300 328 Clause 4.3.2.7	Pass
Transmitter unwanted emissions in the out-of-band domain	EN 300 328 V2.1.1	EN 300 328 V2.1.1 clause 5.4.8.2.1	EN 300 328 Clause 4.3.2.8	Pass
Transmitter unwanted emissions in the spurious domain	EN 300 328 V2.1.1	EN 300 328 V2.1.1 clause 5.4.9.2	EN 300 328 Clause 4.3.2.9	Pass
Receiver spurious emissions	EN 300 328 V2.1.1	EN 300 328 V2.1.1 clause 5.4.10.2	EN 300 328 Clause 4.3.2.10	Pass
Receiver Blocking	EN 300 328 V2.1.1	EN 300 328 V2.1.1 clause 5.4.11.2	EN 300 328 Clause 4.3.2.11	Pass

Remark:

Original model No. in report SZEM190801743702: ID205L.

The model ID205L was only tested in report SZEM190801743702.

New model No. in report SZEM200900995402: Ulefone Watch

This report was an additional report copied from the report SZEM190801743702, just deleted the information of factory and changed the applicant, manufactory, product description, model No. and trade mark. Since according to the declaration from the applicant, the electrical circuit design, layout, components used and internal wiring for the model in the report SZEM190801743702 were exactly the same as the model in this report, only different on mode name.

Therefore original data were kept in this report.



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4 General Information

4.1 Details of E.U.T.

Power supply:	DC 3.8V by rechargeable battery which charged from USB port
Cable:	USB cable: 60cm, Unshielded
Operation Frequency:	2402MHz to 2480MHz
Bluetooth Version:	V4.2
Modulation Type:	GFSK
Number of Channels:	40
Channel Spacing:	2MHz
Antenna Type:	FPC Antenna
Antenna Gain:	-0.49dBi

4.2 Environment Parameter

Environment Parameter	Selected Values During Tests	
Relative Humidity	Ambient	
Value	Temperature(°C)	Voltage(V)
Normal Temperature & Normal Voltage	25	DC3.7V
Low Extreme Test Temperature & Normal Test Voltage	-20	DC3.7V
High Extreme Test Temperature & Normal Test Voltage	55	DC3.7V

4.3 Description of Support Units

The EUT has been tested as an independent unit.



4.4 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	$\pm 7.25 \times 10^{-8}$
2	Duty cycle	$\pm 0.37\%$
3	Occupied Bandwidth	$\pm 3\%$
4	RF conducted power	$\pm 0.75\text{dB}$
5	RF power density	$\pm 2.84\text{dB}$
6	Conducted Spurious emissions	$\pm 0.75\text{dB}$
7	RF Radiated power	$\pm 4.5\text{dB}$ (Below 1GHz)
8		$\pm 4.8\text{dB}$ (Above 1GHz)
9	Radiated Spurious emission test	$\pm 4.5\text{dB}$ (Below 1GHz)
		$\pm 4.8\text{dB}$ (Above 1GHz)
	Temperature test	$\pm 1^\circ\text{C}$
10	Humidity test	$\pm 3\%$
11	Supply voltages	$\pm 1.5\%$
12	Time	$\pm 3\%$



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4.5 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.

4.6 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.

- **Innovation, Science and Economic Development Canada**

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

CAB identifier: CN0006.

IC#: 4620C.

4.7 Deviation from Standards

None

4.8 Abnormalities from Standard Conditions

None



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5 Equipment List

RF Output Power					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Shielding Room	SAEMC	MSR433	SEM001-11	2019-06-13	2022-06-12
EXA Spectrum Analyzer	KEYSIGHT	N9010A	SEM004-09	2019-04-12	2020-04-11
Signal Generator (9kHz-3GHz)	KEYSIGHT	N5171B	SEM006-13	2019-04-12	2020-04-11
Measurement Software	JS Tonscend	JS1120-2 BT/WIFI V2.	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM028-01	2019-07-11	2020-07-10
MXG Vector Signal Generator	KEYSIGHT	N5182A	SEM006-14	2019-04-12	2020-04-11
DC Power Supply	KEYSIGHT	E3642A	SEM011-07	2019-04-12	2020-04-11
Manual Step Attenuator	KEYSIGHT	8494B	SEM021-05	2019-04-12	2020-04-11
Manual Step Attenuator	KEYSIGHT	8496B	SEM021-06	2019-04-12	2020-04-11
Power Sensor	KEYSIGHT	U2021XA	SEM009-13	2019-04-12	2020-04-11
Power Sensor	KEYSIGHT	U2021XA	SEM009-14	2019-04-12	2020-04-11
Power Sensor	KEYSIGHT	U2021XA	SEM009-15	2019-04-12	2020-04-11
Power Sensor	KEYSIGHT	U2021XA	SEM009-16	2019-04-12	2020-04-11
Universal Radio Communication Tester	Rohde & Schwarz	CMW 500	SEM010-03	2019-04-02	2020-04-01
Programmable Temperature & Humidity Chamber	Votsch Industrietechnik GmbH	VT 4002	SEM002-15	2019-04-01	2020-03-31
ESG Vector Signal Generator	Agilent	E4438C	SEM006-15	2018-09-27	2019-09-26

Power Spectral Density					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Shielding Room	SAEMC	MSR433	SEM001-11	2019-06-13	2022-06-12
EXA Spectrum Analyzer	KEYSIGHT	N9010A	SEM004-09	2019-04-12	2020-04-11
Signal Generator (9kHz-3GHz)	KEYSIGHT	N5171B	SEM006-13	2019-04-12	2020-04-11
Measurement Software	JS Tonscend	JS1120-2 BT/WIFI V2.	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM028-01	2019-07-11	2020-07-10
MXG Vector Signal Generator	KEYSIGHT	N5182A	SEM006-14	2019-04-12	2020-04-11
DC Power Supply	KEYSIGHT	E3642A	SEM011-07	2019-04-12	2020-04-11
Manual Step Attenuator	KEYSIGHT	8494B	SEM021-05	2019-04-12	2020-04-11
Manual Step Attenuator	KEYSIGHT	8496B	SEM021-06	2019-04-12	2020-04-11



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Power Sensor	KEYSIGHT	U2021XA	SEM009-13	2019-04-12	2020-04-11
Power Sensor	KEYSIGHT	U2021XA	SEM009-14	2019-04-12	2020-04-11
Power Sensor	KEYSIGHT	U2021XA	SEM009-15	2019-04-12	2020-04-11
Power Sensor	KEYSIGHT	U2021XA	SEM009-16	2019-04-12	2020-04-11
Universal Radio Communication Tester	Rohde & Schwarz	CMW 500	SEM010-03	2019-04-02	2020-04-01
Programmable Temperature & Humidity Chamber	Votsch Industrietechnik GmbH	VT 4002	SEM002-15	2019-04-01	2020-03-31
ESG Vector Signal Generator	Agilent	E4438C	SEM006-15	2018-09-27	2019-09-26

Occupied Channel Bandwidth					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Shielding Room	SAEMC	MSR433	SEM001-11	2019-06-13	2022-06-12
EXA Spectrum Analyzer	KEYSIGHT	N9010A	SEM004-09	2019-04-12	2020-04-11
Signal Generator (9kHz-3GHz)	KEYSIGHT	N5171B	SEM006-13	2019-04-12	2020-04-11
Measurement Software	JS Tonscend	JS1120-2 BT/WIFI V2.	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM028-01	2019-07-11	2020-07-10
MXG Vector Signal Generator	KEYSIGHT	N5182A	SEM006-14	2019-04-12	2020-04-11
DC Power Supply	KEYSIGHT	E3642A	SEM011-07	2019-04-12	2020-04-11
Manual Step Attenuator	KEYSIGHT	8494B	SEM021-05	2019-04-12	2020-04-11
Manual Step Attenuator	KEYSIGHT	8496B	SEM021-06	2019-04-12	2020-04-11
Power Sensor	KEYSIGHT	U2021XA	SEM009-13	2019-04-12	2020-04-11
Power Sensor	KEYSIGHT	U2021XA	SEM009-14	2019-04-12	2020-04-11
Power Sensor	KEYSIGHT	U2021XA	SEM009-15	2019-04-12	2020-04-11
Power Sensor	KEYSIGHT	U2021XA	SEM009-16	2019-04-12	2020-04-11
Universal Radio Communication Tester	Rohde & Schwarz	CMW 500	SEM010-03	2019-04-02	2020-04-01
Programmable Temperature & Humidity Chamber	Votsch Industrietechnik GmbH	VT 4002	SEM002-15	2019-04-01	2020-03-31
ESG Vector Signal Generator	Agilent	E4438C	SEM006-15	2018-09-27	2019-09-26

Transmitter unwanted emissions in the out-of-band domain					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Shielding Room	SAEMC	MSR433	SEM001-11	2019-06-13	2022-06-12
EXA Spectrum Analyzer	KEYSIGHT	N9010A	SEM004-09	2019-04-12	2020-04-11



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Signal Generator (9kHz-3GHz)	KEYSIGHT	N5171B	SEM006-13	2019-04-12	2020-04-11
Measurement Software	JS Tonscend	JS1120-2 BT/WIFI V2.	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM028-01	2019-07-11	2020-07-10
MXG Vector Signal Generator	KEYSIGHT	N5182A	SEM006-14	2019-04-12	2020-04-11
DC Power Supply	KEYSIGHT	E3642A	SEM011-07	2019-04-12	2020-04-11
Manual Step Attenuator	KEYSIGHT	8494B	SEM021-05	2019-04-12	2020-04-11
Manual Step Attenuator	KEYSIGHT	8496B	SEM021-06	2019-04-12	2020-04-11
Power Sensor	KEYSIGHT	U2021XA	SEM009-13	2019-04-12	2020-04-11
Power Sensor	KEYSIGHT	U2021XA	SEM009-14	2019-04-12	2020-04-11
Power Sensor	KEYSIGHT	U2021XA	SEM009-15	2019-04-12	2020-04-11
Power Sensor	KEYSIGHT	U2021XA	SEM009-16	2019-04-12	2020-04-11
Universal Radio Communication Tester	Rohde & Schwarz	CMW 500	SEM010-03	2019-04-02	2020-04-01
Programmable Temperature & Humidity Chamber	Votsch Industrietechnik GmbH	VT 4002	SEM002-15	2019-04-01	2020-03-31
ESG Vector Signal Generator	Agilent	E4438C	SEM006-15	2018-09-27	2019-09-26

Transmitter unwanted emissions in the spurious domain

Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2018-03-13	2021-03-12
Measurement Software	AUDIX	e3 V8.2014-6- 27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM026-01	2019-07-11	2020-07-10
EXA Spectrum Analyzer	AgilentTechnologies Inc	N9010A	SEM004-12	2019-04-12	2020-04-11
Horn Antenna (1-18GHz)	Rohde & Schwarz	HF907	SEM003-07	2018-04-13	2021-04-12
Horn Antenna (15GHz-40GHz)	Schwarzbeck	BBHA 9170	SEM003-15	2017-10-17	2020-10-16
Pre-Amplifier (0.1-26.5GHz)	Compliance Directions Systems Inc.	PAP-0126	SEM004-11	2018-11-12	2019-11-11
Pre-amplifier (18-26GHz)	Rohde & Schwarz	CH14-H052	SEM005-17	2019-04-01	2020-03-31
Pre-amplifier (26GHz-40GHz)	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2019-04-01	2020-03-31
DC Power Supply	Zhao Xin	RXN-305D	SEM011-02	2018-09-25	2019-09-24



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Active Loop Antenna	ETS-Lindgren	6502	SEM003-08	2017-08-22	2020-08-21
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Receiver spurious emissions

Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2018-03-13	2021-03-12
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM026-01	2019-07-11	2020-07-10
EXA Spectrum Analyzer	Agilent Technologies Inc	N9010A	SEM004-12	2019-04-12	2020-04-11
Horn Antenna (1-18GHz)	Rohde & Schwarz	HF907	SEM003-07	2018-04-13	2021-04-12
Horn Antenna (15GHz-40GHz)	Schwarzbeck	BBHA 9170	SEM003-15	2017-10-17	2020-10-16
Pre-Amplifier (0.1-26.5GHz)	Compliance Directions Systems Inc.	PAP-0126	SEM004-11	2018-11-12	2019-11-11
Pre-amplifier (18-26GHz)	Rohde & Schwarz	CH14-H052	SEM005-17	2019-04-01	2020-03-31
Pre-amplifier (26GHz-40GHz)	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2019-04-01	2020-03-31
DC Power Supply	Zhao Xin	RXN-305D	SEM011-02	2018-09-25	2019-09-24
Active Loop Antenna	ETS-Lindgren	6502	SEM003-08	2017-08-22	2020-08-21

Receiver Blocking

Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Shielding Room	SAEMC	MSR433	SEM001-11	2019-06-13	2022-06-12
EXA Spectrum Analyzer	KEYSIGHT	N9010A	SEM004-09	2019-04-12	2020-04-11
Signal Generator (9kHz-3GHz)	KEYSIGHT	N5171B	SEM006-13	2019-04-12	2020-04-11
Measurement Software	JS Tonscend	JS1120-2 BT/WIFI V2.	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM028-01	2019-07-11	2020-07-10
MXG Vector Signal Generator	KEYSIGHT	N5182A	SEM006-14	2019-04-12	2020-04-11
DC Power Supply	KEYSIGHT	E3642A	SEM011-07	2019-04-12	2020-04-11
Manual Step Attenuator	KEYSIGHT	8494B	SEM021-05	2019-04-12	2020-04-11
Manual Step Attenuator	KEYSIGHT	8496B	SEM021-06	2019-04-12	2020-04-11
Power Sensor	KEYSIGHT	U2021XA	SEM009-13	2019-04-12	2020-04-11
Power Sensor	KEYSIGHT	U2021XA	SEM009-14	2019-04-12	2020-04-11
Power Sensor	KEYSIGHT	U2021XA	SEM009-15	2019-04-12	2020-04-11



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Power Sensor	KEYSIGHT	U2021XA	SEM009-16	2019-04-12	2020-04-11
Universal Radio Communication Tester	Rohde & Schwarz	CMW 500	SEM010-03	2019-04-02	2020-04-01
Programmable Temperature & Humidity Chamber	Votsch Industrietechnik GmbH	VT 4002	SEM002-15	2019-04-01	2020-03-31
ESG Vector Signal Generator	Agilent	E4438C	SEM006-15	2018-09-27	2019-09-26

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	2018-09-27	2019-09-26
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-04	2018-09-27	2019-09-26
Humidity/ Temperature Indicator	Mingle	N/A	SEM002-08	2018-09-27	2019-09-26
Barometer	Changchun Meteorological Industry Factory	DYM3	SEM002-01	2019-04-04	2020-04-03



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6 Radio Spectrum Technical Requirement

6.1 Geo-location capability

6.1.1 Test Requirement:

EN 300 328 Clause 4.3.2.12

Limit: This requirement only applies to equipment with geo-location capability as defined in clause 4.3.1.13.2.

6.1.2 Conclusion

Standard Requirement:

The geographical location determined by the equipment as defined in clause below shall not be accessible to the user.

Geo-location capability is a feature of the equipment to determine its geographical location with the purpose to configure itself according to the regulatory requirements applicable at the geographical location where it operates.

The geo-location capability may be present in the equipment or in an external device (temporary) associated with the equipment operating at the same geographical location during the initial power up of the equipment. The geographical location may also be available in equipment already installed and operating at the same geographical location.

The applicant declares:

The product does not have the geo-location function.

7 Radio Spectrum Matter Test Results

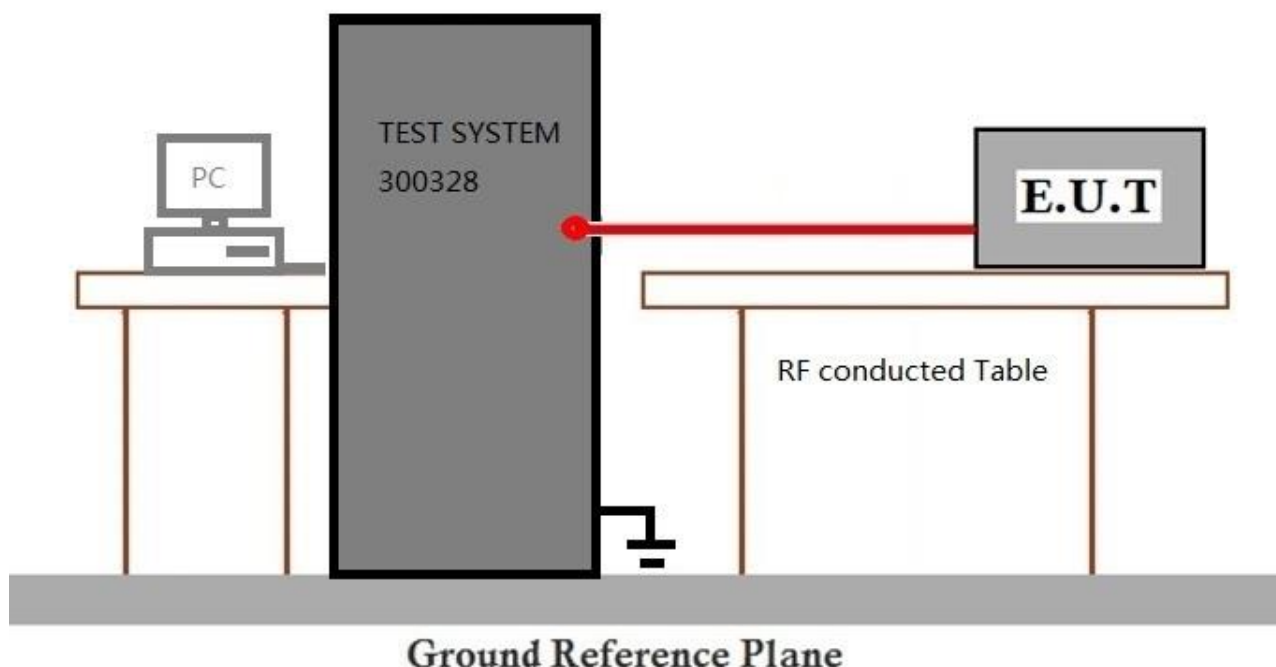
7.1 RF Output Power

Test Requirement EN 300 328 Clause 4.3.2.2
Test Method: EN 300 328 V2.1.1 clause 5.4.2.2.1.2
Limit: 20dBm/(100mw) (e.i.r.p)

7.1.1 E.U.T. Operation

Operating Environment:
Temperature: 22.8 °C Humidity: 44 % RH Atmospheric Pressure: 1000 mbar
Test mode a:TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation

7.1.2 Test Setup Diagram



7.1.3 Measurement Procedure and Data

The detailed test data see: Appendix 300328

7.2 Power Spectral Density

Test Requirement EN 300 328 Clause 4.3.2.3
Test Method: EN 300 328 V2.1.1 clause 5.4.3.2.1
Limit: $\leq 10\text{dBm per MHz}$

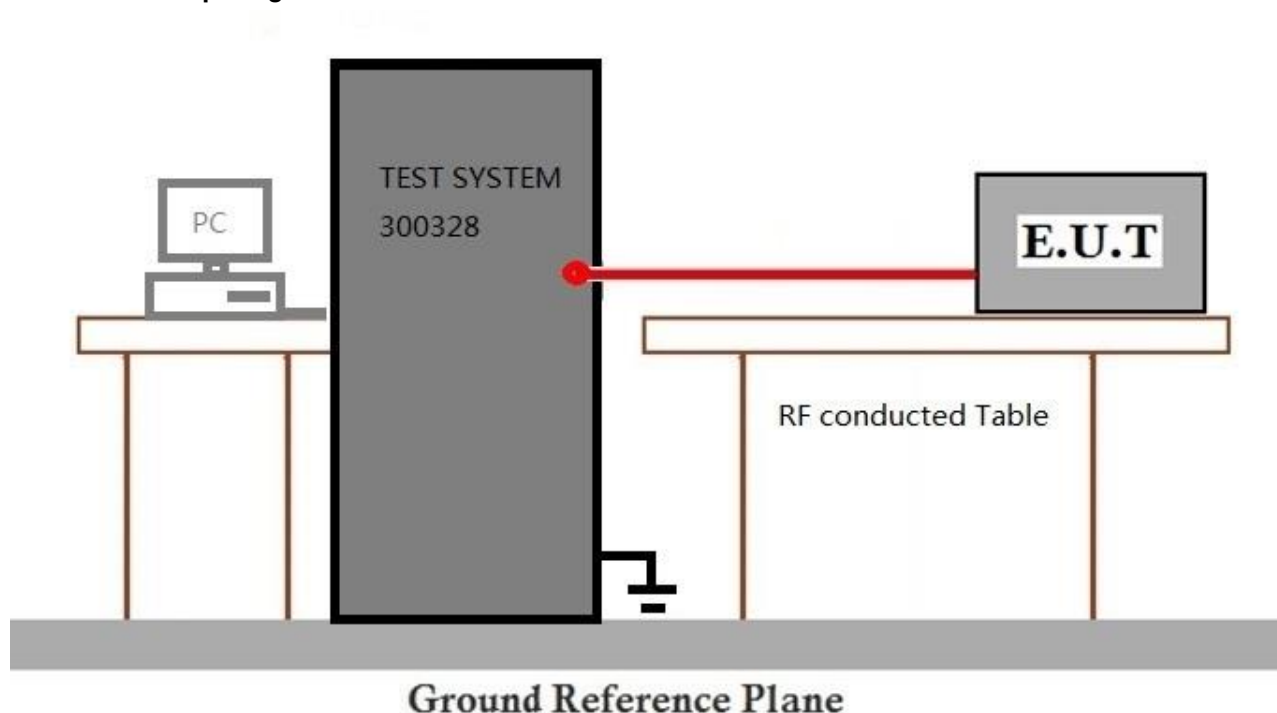
7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 22.8 °C Humidity: 43.9 % RH Atmospheric Pressure: 1000 mbar

Test mode a:TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation

7.2.2 Test Setup Diagram



7.2.3 Measurement Procedure and Data

The detailed test data see: Appendix 300328

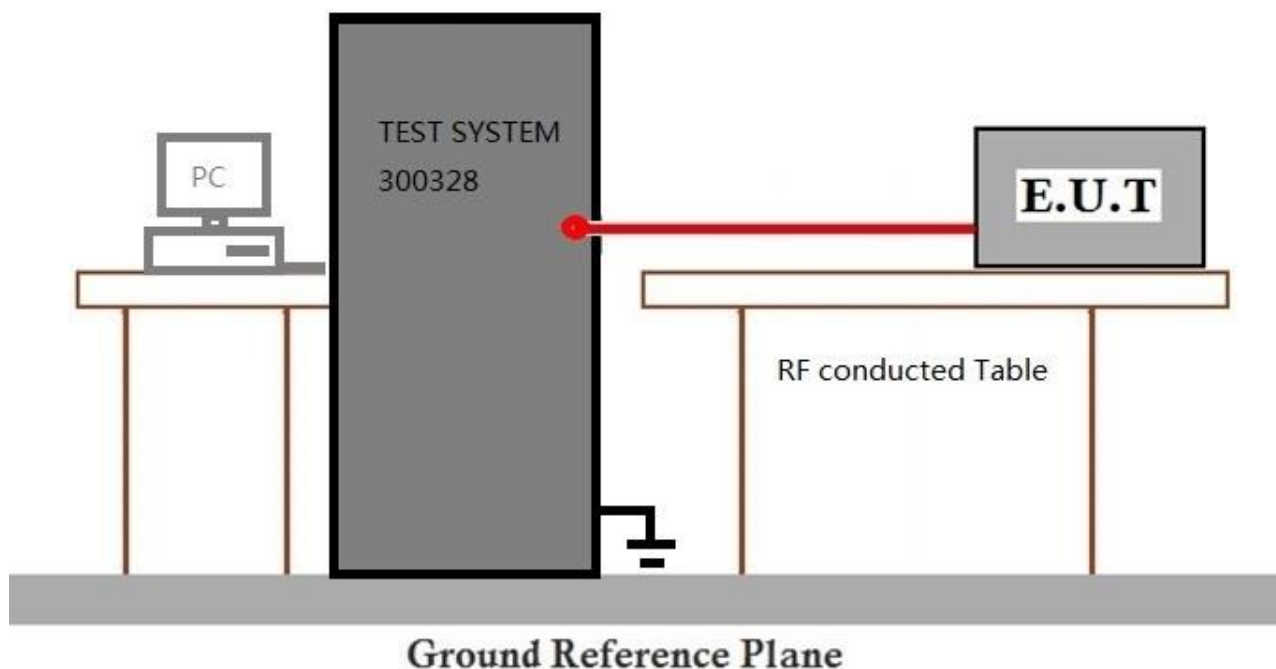
7.3 Occupied Channel Bandwidth

Test Requirement	EN 300 328 Clause 4.3.2.7
Test Method:	EN 300 328 V2.1.1 clause 5.4.7.2.1
Limit:	The Occupied Channel Bandwidth shall fall completely within the band given in clause 1. For non-adaptive Frequency Hopping equipment with e.i.r.p. greater than 10 dBm, the Occupied Channel Bandwidth for every occupied hopping frequency shall be equal to or less than the Nominal Channel Bandwidth declared by the manufacturer. See clause 5.4.1 j). This declared value shall not be greater than 5 MHz. The Occupied Channel Bandwidth shall fall completely within the band given in table 1. In addition, for non-adaptive equipment using wide band modulations other than FHSS and with e.i.r.p. greater than 10 dBm, the occupied channel bandwidth shall be less than 20 MHz.

7.3.1 E.U.T. Operation

Operating Environment:					
Temperature:	22.8 °C	Humidity:	44 % RH	Atmospheric Pressure:	1000 mbar
Test mode	a:TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation				

7.3.2 Test Setup Diagram



7.3.3 Measurement Procedure and Data

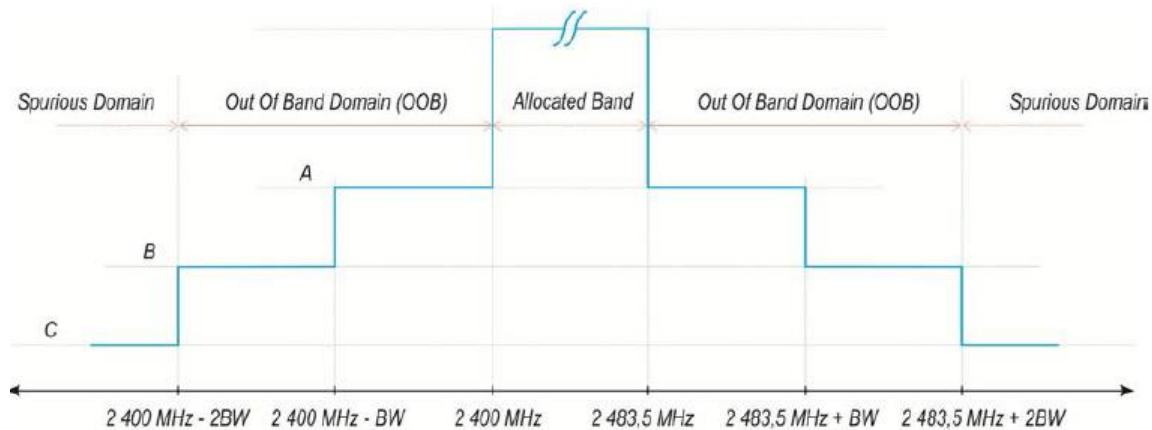
The detailed test data see: Appendix 300328

7.4 Transmitter unwanted emissions in the out-of-band domain

Test Requirement EN 300 328 Clause 4.3.2.8

Test Method: EN 300 328 V2.1.1 clause 5.4.8.2.1

Limit:



A: -10 dBm/MHz e.i.r.p.

B: -20 dBm/MHz e.i.r.p.

C: Spurious Domain limits

BW = Occupied Channel Bandwidth in MHz or 1 MHz whichever is greater



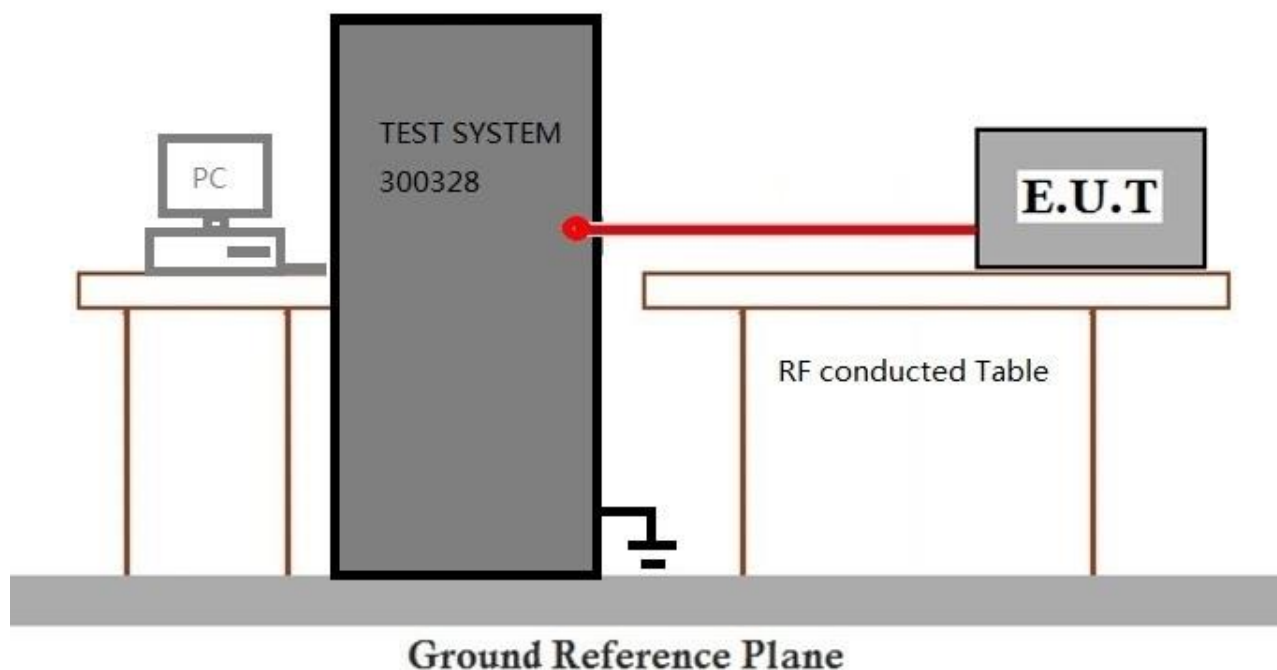
7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 22.8 °C Humidity: 43.9 % RH Atmospheric Pressure: 1000 mbar

Test mode a:TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation

7.4.2 Test Setup Diagram



7.4.3 Measurement Procedure and Data

The detailed test data see: Appendix 300328

7.5 Transmitter unwanted emissions in the spurious domain

Test Requirement EN 300 328 Clause 4.3.2.9
Test Method: EN 300 328 V2.1.1 clause 5.4.9.2
Measurement Distance: 3m
Limit:

Table 1: Transmitter limits for spurious emissions

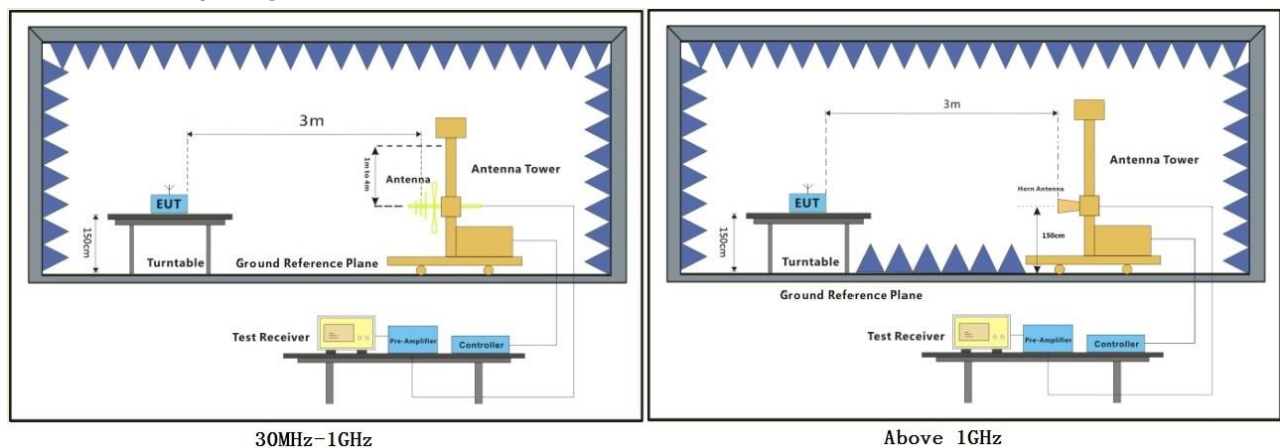
Frequency range	Maximum power, e.r.p. (≤ 1 GHz) e.i.r.p. (> 1 GHz)	Bandwidth
30 MHz to 47 MHz	-36dBm	100 kHz
47 MHz to 74 MHz	-54dBm	100 kHz
74 MHz to 87,5 MHz	-36dBm	100 kHz
87,5 MHz to 118 MHz	-54dBm	100 kHz
118 MHz to 174 MHz	-36dBm	100 kHz
174 MHz to 230 MHz	-54dBm	100 kHz
230 MHz to 470 MHz	-36dBm	100 kHz
470 MHz to 862 MHz	-54dBm	100 kHz
862 MHz to 1 GHz	-36dBm	100 kHz
1 GHz to 12,75 GHz	-30dBm	1MHz

7.5.1 E.U.T. Operation

Operating Environment:

Temperature: 23.7 °C Humidity: 55.3 % RH Atmospheric Pressure: 1000 mbar
Test mode a:TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation

7.5.2 Test Setup Diagram





7.5.3 Measurement Procedure and Data

1. Scan from 30MHz to 12.75GHz, find the maximum radiation frequency to measure.
2. The technique used to find the Spurious Emissions of the transmitter was the antenna substitution method. Substitution method was performed to determine the actual ERP/EIRP emission levels of the EUT.

Below 1GHz test procedure as below:

- 1) The EUT was powered on and placed on a table in the chamber. The antenna of the transmitter was extended to its maximum length. modulation mode and the measuring receiver shall be tuned to the frequency of the transmitter under test.
- 2) Rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made.
- 3) Steps 1) and 2) were performed with the EUT and the receive antenna in both vertical and horizontal polarization.
- 4) The transmitter was then removed and replaced with another antenna. The center of the antenna was approximately at the same location as the center of the transmitter.
- 5) A signal at the disturbance was fed to the substitution antenna by means of a non-radiating cable. With both the substitution and the receive antennas horizontally polarized, the receive antenna was raised and lowered to obtain a maximum reading at the test receiver. The level of the signal generator was adjusted until the measured field strength level in step 2) is obtained for this set of conditions.
- 6) The output power into the substitution antenna was then measured.
- 7) Steps 5) and 6) were repeated with both antennas vertically polarized.
- 8) Calculate power in dBm by the following formula:

$$\text{ERP(dBm)} = \text{Pg(dBm)} - \text{cable loss (dB)} + \text{antenna gain (dBi)}$$

where:

Pg is the generator output power into the substitution antenna.

Above 1GHz test procedure as below:

- 1) Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber.
- 2) Calculate power in dBm by the following formula:

$$\text{EIRP(dBm)} = \text{Pg(dBm)} - \text{cable loss (dB)} + \text{antenna gain (dBi)}$$

$$\text{EIRP} = \text{ERP} + 2.15\text{dB}$$

where:

Pg is the generator output power into the substitution antenna.

Remark:

The disturbance below 1GHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed.

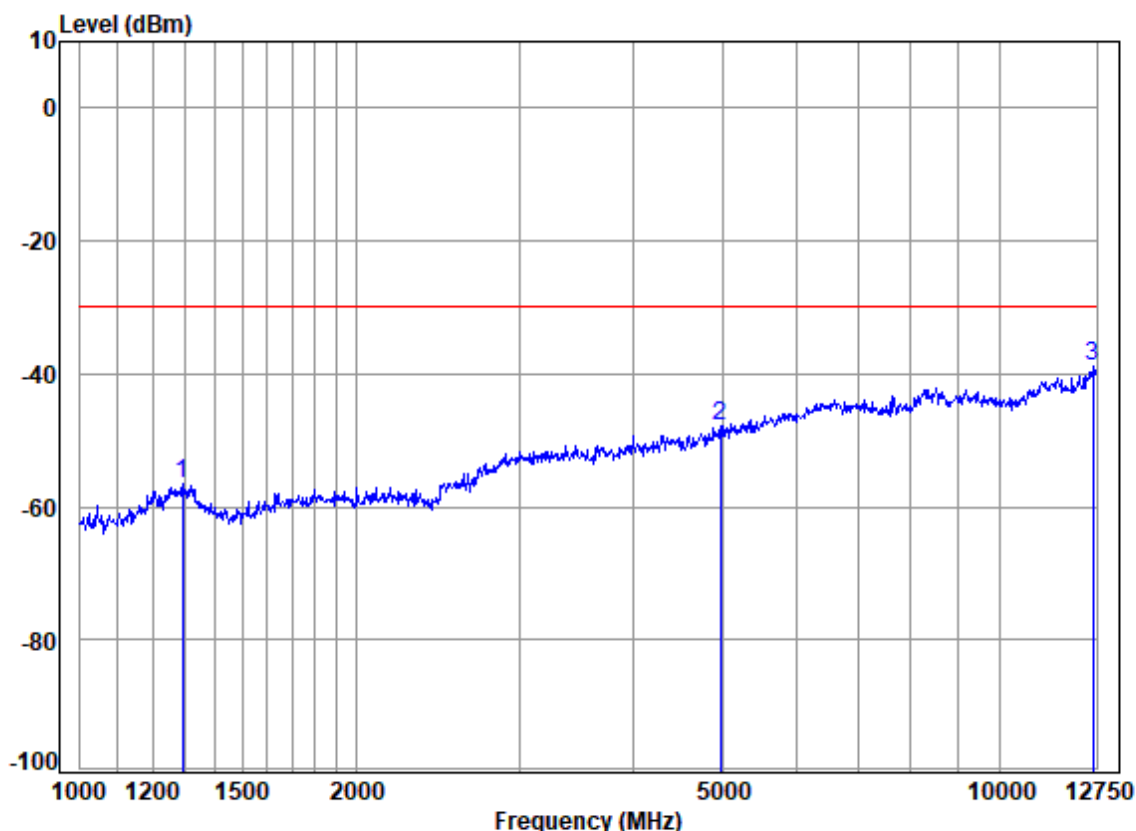


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Mode:a; Polarization:Horizontal; Modulation:GFSK; ; Channel:Low



Condition: 3m HORIZONTAL

Job No.: 17437CR

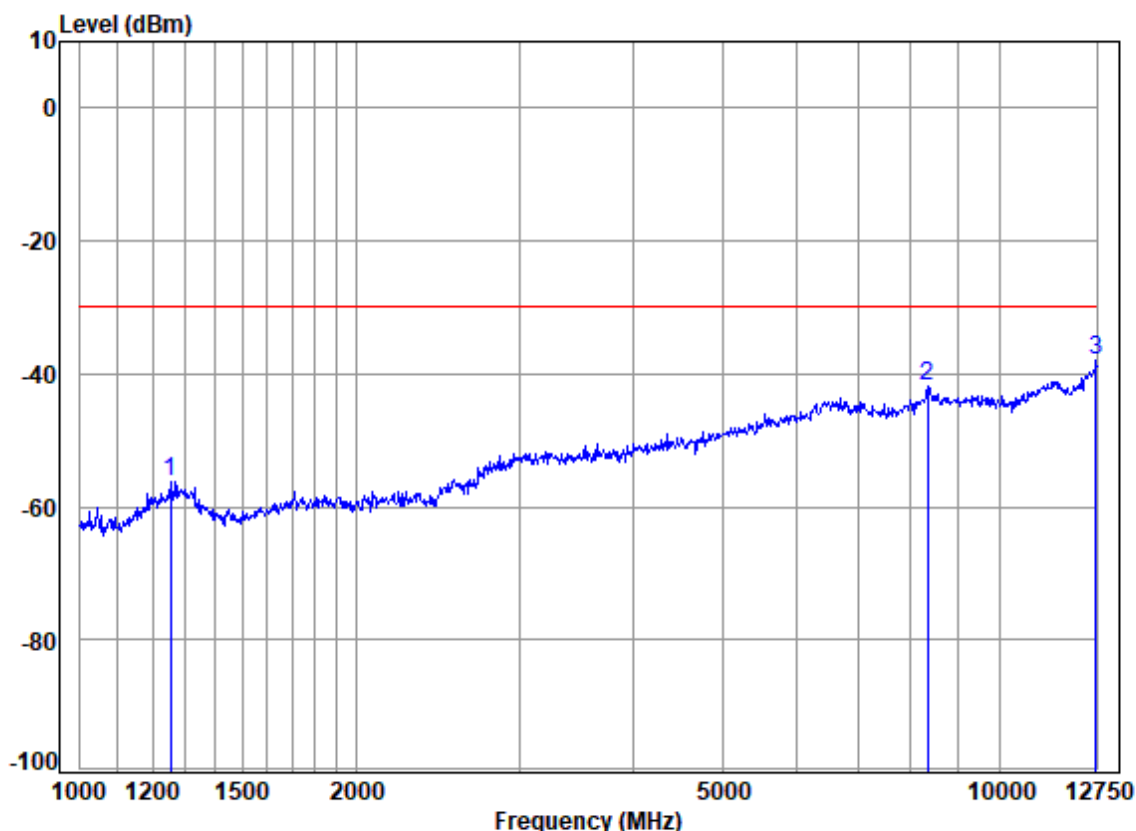
Test mode: 2402 TX RSE

MEMO: BLE

Marker	Freq. MHz	Level dBm	Limit dBm	Over Limit dB
1	1293.17	-56.52	-30.00	-26.52
2	4971.32	-47.78	-30.00	-17.78
3	12620.84	-38.94	-30.00	-8.94



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

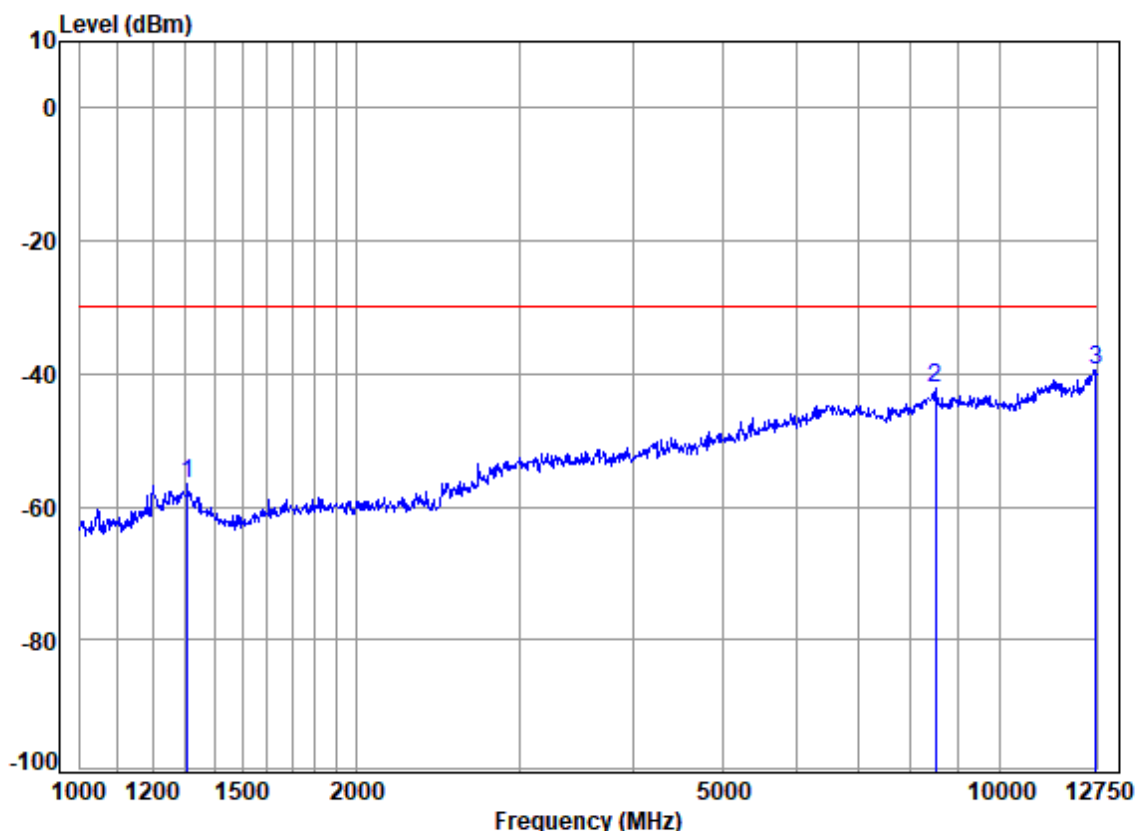


Condition: 3m VERTICAL
Job No.: 17437CR
Test mode: 2402 TX RSE
MEMO: BLE

Marker	Freq. MHz	Level dBm	Limit dBm	Over Limit dB
1	1254.27	-56.29	-30.00	-26.29
2	8334.70	-41.94	-30.00	-11.94
3	12717.59	-38.07	-30.00	-8.07



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



Condition: 3m HORIZONTAL
Job No.: 17437CR
Test mode: 2480 TX RSE
MEMO: BLE

Marker	Freq. MHz	Level dBm	Limit dBm	Over Limit dB
1	1309.74	-56.63	-30.00	-26.63
2	8506.17	-42.16	-30.00	-12.16
3	12717.59	-39.40	-30.00	-9.40



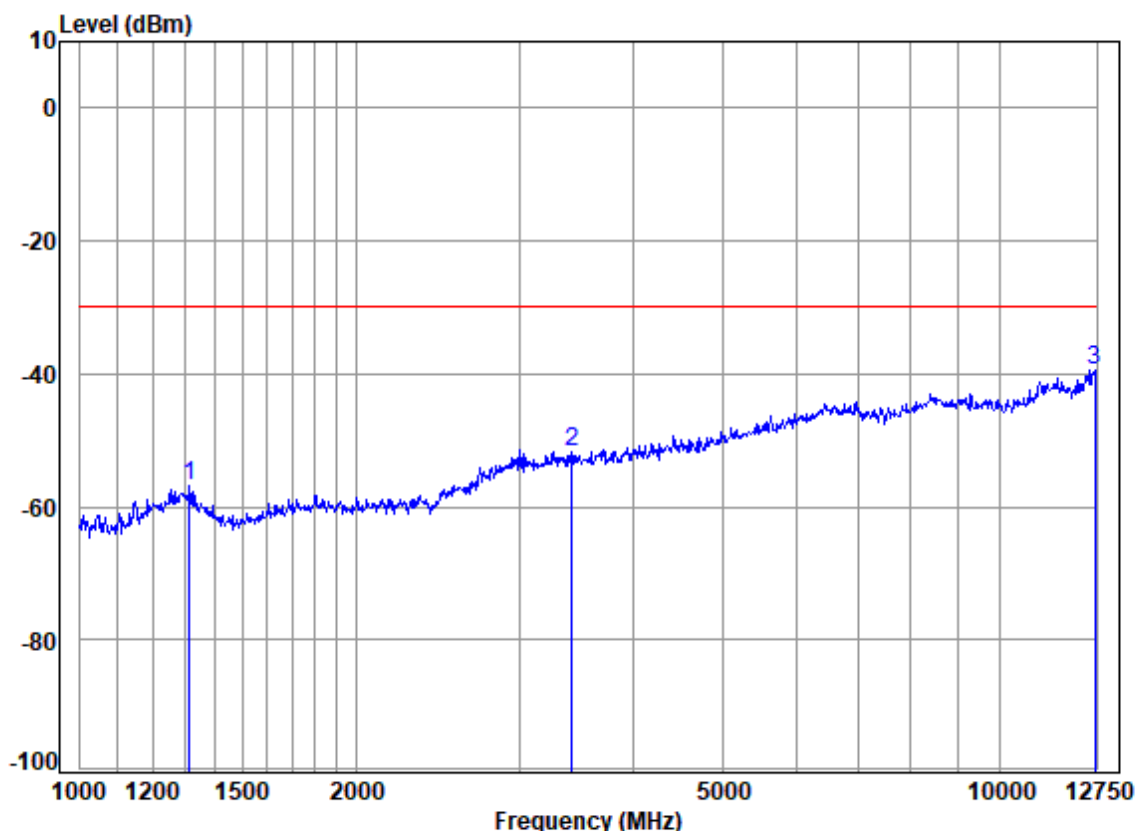
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Mode:a; Polarization:Vertical; Modulation:GFSK; ; Channel:High



Condition: 3m VERTICAL
Job No.: 17437CR
Test mode: 2480 TX RSE
MEMO: BLE

Marker	Freq. MHz	Level dBm	Limit dBm	Over Limit dB
1	1316.42	-56.86	-30.00	-26.86
2	3428.21	-51.61	-30.00	-21.61
3	12685.25	-39.35	-30.00	-9.35



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7.6 Receiver spurious emissions

Test Requirement EN 300 328 Clause 4.3.2.10
Test Method: EN 300 328 V2.1.1 clause 5.4.10.2
Measurement Distance: 3m
Limit:

The spurious emissions of the receiver shall not exceed the values in tables in the indicated bands:

Frequency Range	Limit
25MHz to 1GHz	2nw(-57dBm)
Above 1GHz	20nw(-47dBm)

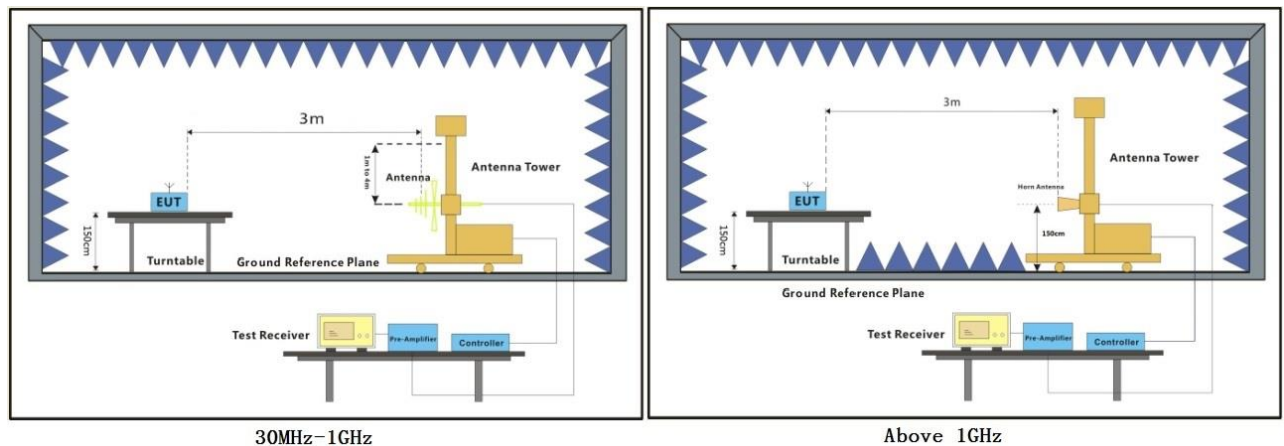
7.6.1 E.U.T. Operation

Operating Environment:

Temperature: 23.7 °C Humidity: 55.3 % RH Atmospheric Pressure: 1000 mbar

Test mode b:RX_Keep the EUT in receiving mode with GFSK modulation.

7.6.2 Test Setup Diagram



7.6.3 Measurement Procedure and Data

1. Scan from 30MHz to 12.75GHz, find the maximum radiation frequency to measure.
2. The technique used to find the Spurious Emissions of the transmitter was the antenna substitution method. Substitution method was performed to determine the actual ERP/EIRP emission levels of the EUT.

Below 1GHz test procedure as below:

- 1) The EUT was powered on and placed on a table in the chamber. The antenna of the transmitter was extended to its maximum length. Receiver mode and the measuring receiver shall be tuned to the frequency of the transmitter under test.
- 2) Rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made.
- 3) Steps 1) and 2) were performed with the EUT and the receive antenna in both vertical and horizontal polarization.
- 4) The transmitter was then removed and replaced with another antenna. The center of the antenna was approximately at the same location as the center of the transmitter.
- 5) A signal at the disturbance was fed to the substitution antenna by means of a non-radiating cable. With both the substitution and the receive antennas horizontally polarized, the receive antenna was raised and lowered to obtain a maximum reading at the test receiver. The level of the signal generator was adjusted until the measured field strength level in step 2) is obtained for this set of conditions.
- 6) The output power into the substitution antenna was then measured.
- 7) Steps 5) and 6) were repeated with both antennas vertically polarized.
- 8) Calculate power in dBm by the following formula:

$$\text{ERP(dBm)} = \text{Pg(dBm)} - \text{cable loss (dB)} + \text{antenna gain (dBi)}$$

where:

Pg is the generator output power into the substitution antenna.

Above 1GHz test procedure as below:

- 1) Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber.
- 2) Calculate power in dBm by the following formula:

$$\text{EIRP(dBm)} = \text{Pg(dBm)} - \text{cable loss (dB)} + \text{antenna gain (dBi)}$$

$$\text{EIRP} = \text{ERP} + 2.15\text{dB}$$

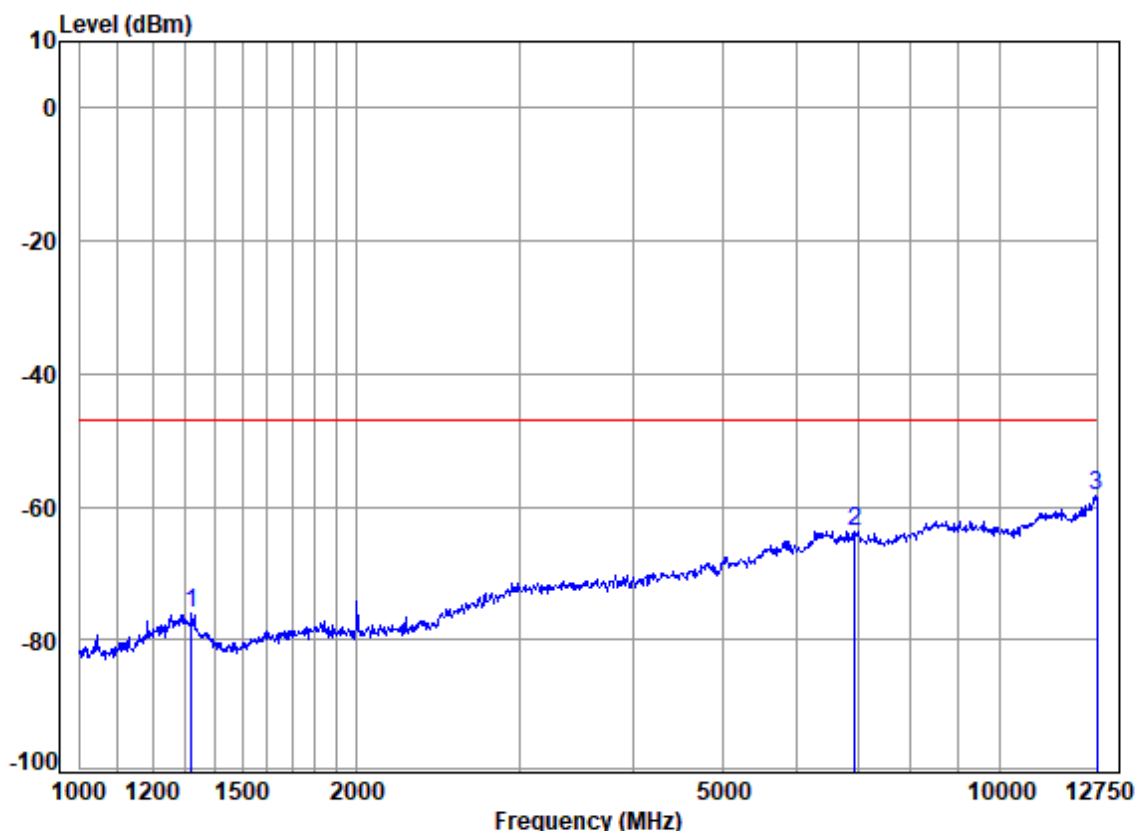
where:

Pg is the generator output power into the substitution antenna.

Remark:

The disturbance below 1GHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed.

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



Condition: 3m HORIZONTAL
Job No.: 17437CR
Test mode: 2402 RX RSE
MEMO: BLE

Marker	Freq. MHz	Level dBm	Limit dBm	Over Limit dB
1	1323.14	-75.88	-47.00	-28.88
2	6956.63	-63.62	-47.00	-16.62
3	12750.00	-58.28	-47.00	-11.28



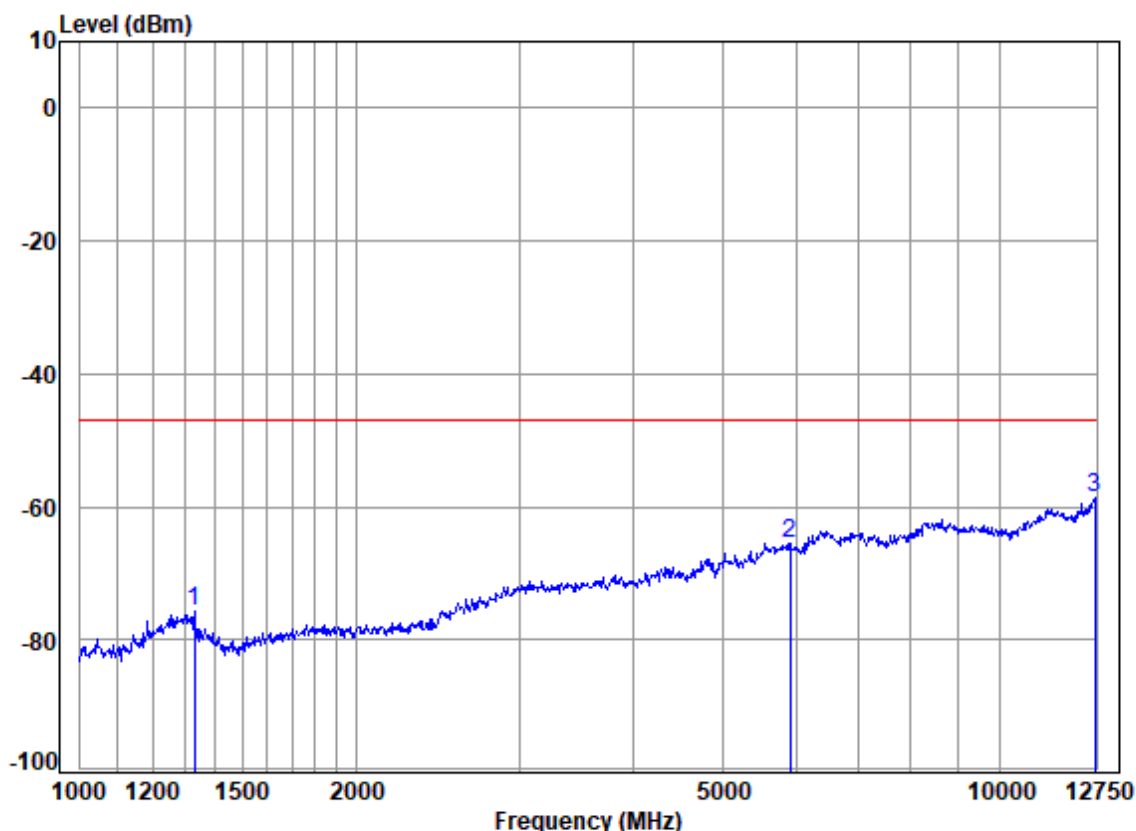
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Mode:b; Polarization:Vertical; Modulation:GFSK; ; Channel:Low



Condition: 3m VERTICAL
Job No.: 17437CR
Test mode: 2402 RX RSE
MEMO: BLE

Marker	Freq. MHz	Level dBm	Limit dBm	Over Limit dB
1	1333.28	-75.63	-47.00	-28.63
2	5910.80	-65.55	-47.00	-18.55
3	12685.25	-58.50	-47.00	-11.50



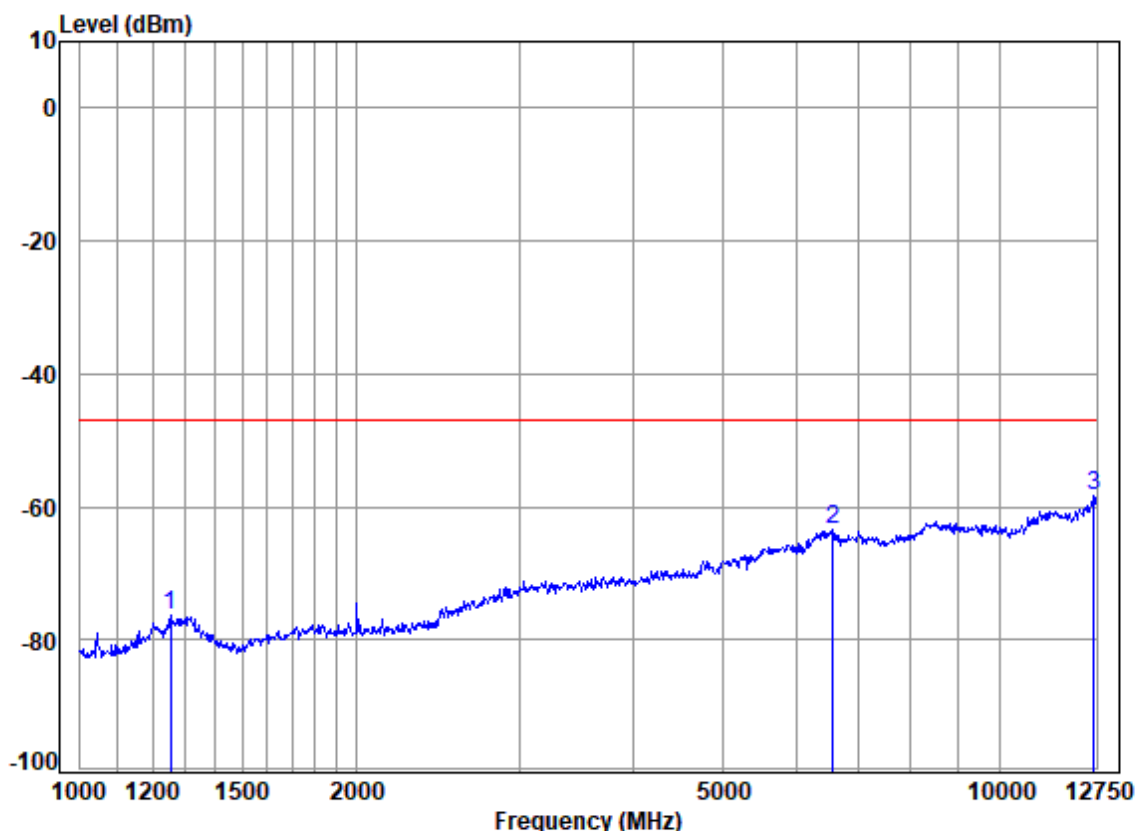
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Mode:b; Polarization:Horizontal; Modulation:GFSK; ; Channel:High



Condition: 3m HORIZONTAL
Job No.: 17437CR
Test mode: 2480 RX RSE
MEMO: BLE

Marker	Freq. MHz	Level dBm	Limit dBm	Over Limit dB
1	1254.27	-76.20	-47.00	-29.20
2	6577.75	-63.56	-47.00	-16.56
3	12653.00	-58.40	-47.00	-11.40



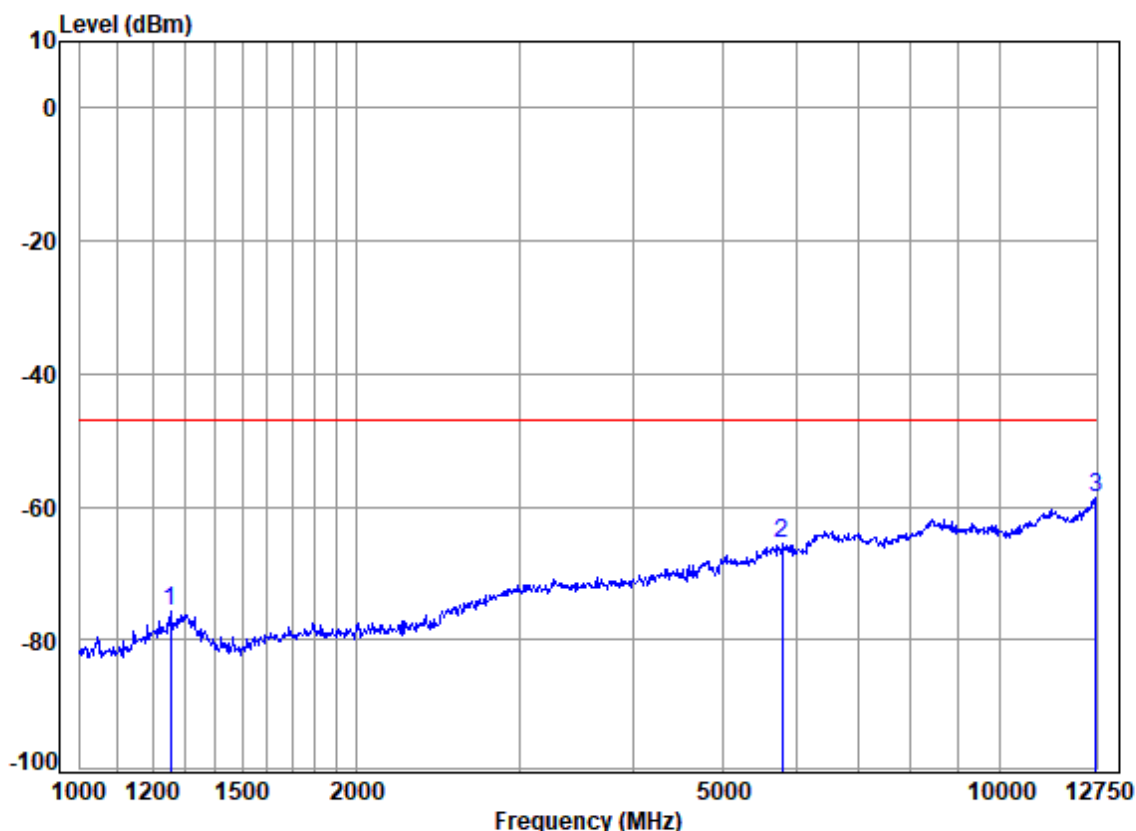
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Mode:b; Polarization:Vertical; Modulation:GFSK; ; Channel:High



Condition: 3m VERTICAL
Job No.: 17437CR
Test mode: 2480 RX RSE
MEMO: BLE

Marker	Freq. MHz	Level dBm	Limit dBm	Over Limit dB
1	1254.27	-75.84	-47.00	-28.84
2	5791.65	-65.58	-47.00	-18.58
3	12717.59	-58.66	-47.00	-11.66



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7.7 Receiver Blocking

Test Requirement EN 300 328 Clause 4.3.2.11
Test Method: EN 300 328 V2.1.1 clause 5.4.11.2
Limit:

While maintaining the minimum performance criteria as, the blocking levels at specified frequency offsets shall be equal to or greater than the limits defined for the applicable receiver category provided in below table.

Receiver Blocking parameters for Receiver Category 1 equipment			
Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)	Type of blocking signal
Pmin + 6 dB	2380 2503.5	-53	CW
Pmin + 6 dB	2300 2330 2360	-47	CW
Pmin + 6 dB	2523.5 2553.5 2583.5 2613.5 2643.5 2673.5	-47	CW
NOTE 1: Pmin is the minimum level of wanted signal (in dBm) required to meet the minimum performance criteria in the absence of any blocking signal.			
NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.			

Receiver Blocking parameters for Receiver Category 2 equipment			
Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)	Type of blocking signal
Pmin + 6 dB	2380 2503.5	-57	CW
Pmin + 6 dB	2300 2583.5	-47	CW
NOTE 1: Pmin is the minimum level of wanted signal (in dBm) required to meet the minimum performance criteria as defined in the absence of any blocking signal.			
NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.			



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Receiver Blocking parameters for Receiver Category 3 equipment			
Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)	Type of blocking signal
Pmin + 12 dB	2380 2503.5	-57	CW
Pmin + 12 dB	2300 2583.5	-47	CW

NOTE 1: Pmin is the minimum level of wanted signal (in dBm) required to meet the minimum performance criteria as defined in the absence of any blocking signal.

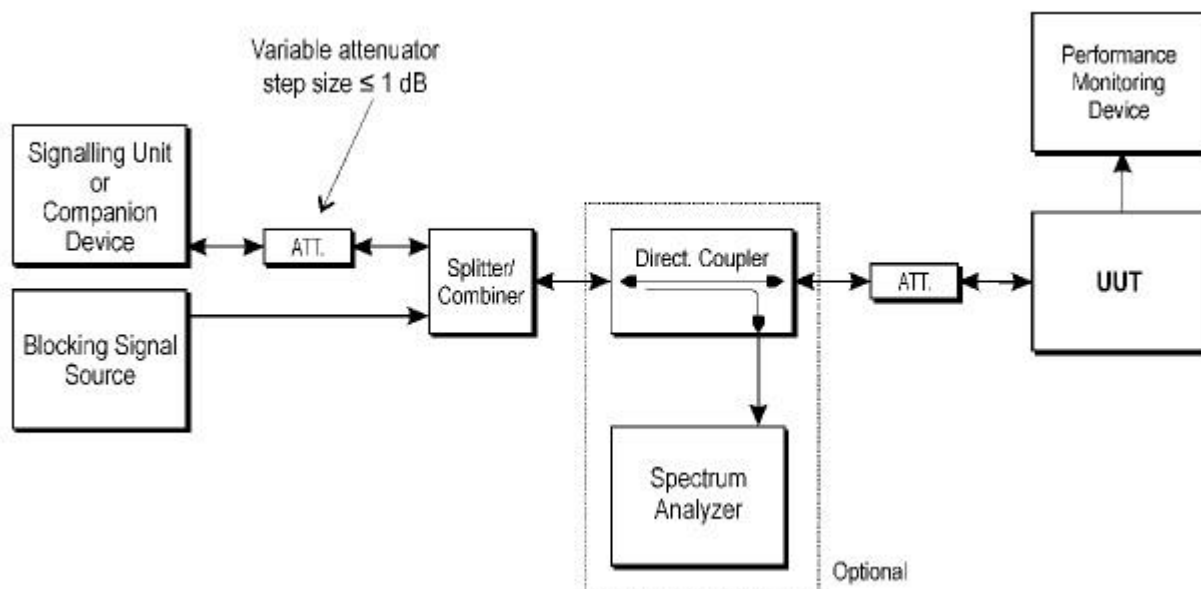
NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.

7.7.1 E.U.T. Operation

Operating Environment:

Temperature: 22.8 °C Humidity: 44 % RH Atmospheric Pressure: 1000 mbar
Test mode c:Normal operating_Keep the EUT communication with the companion device.

7.7.2 Test Setup Diagram

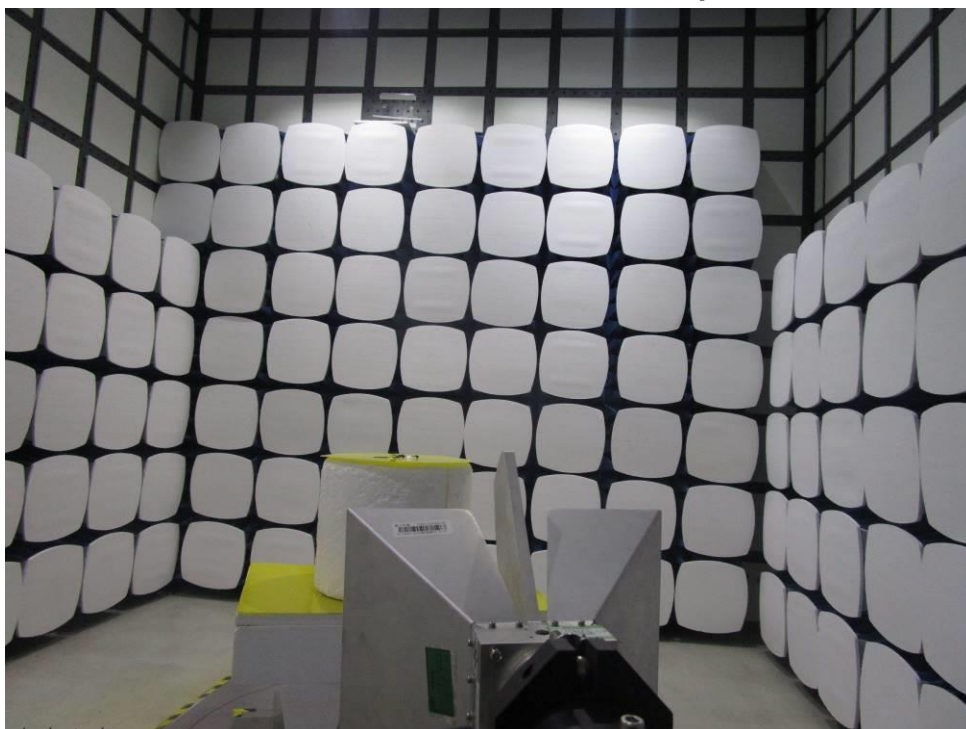


7.7.3 Measurement Procedure and Data

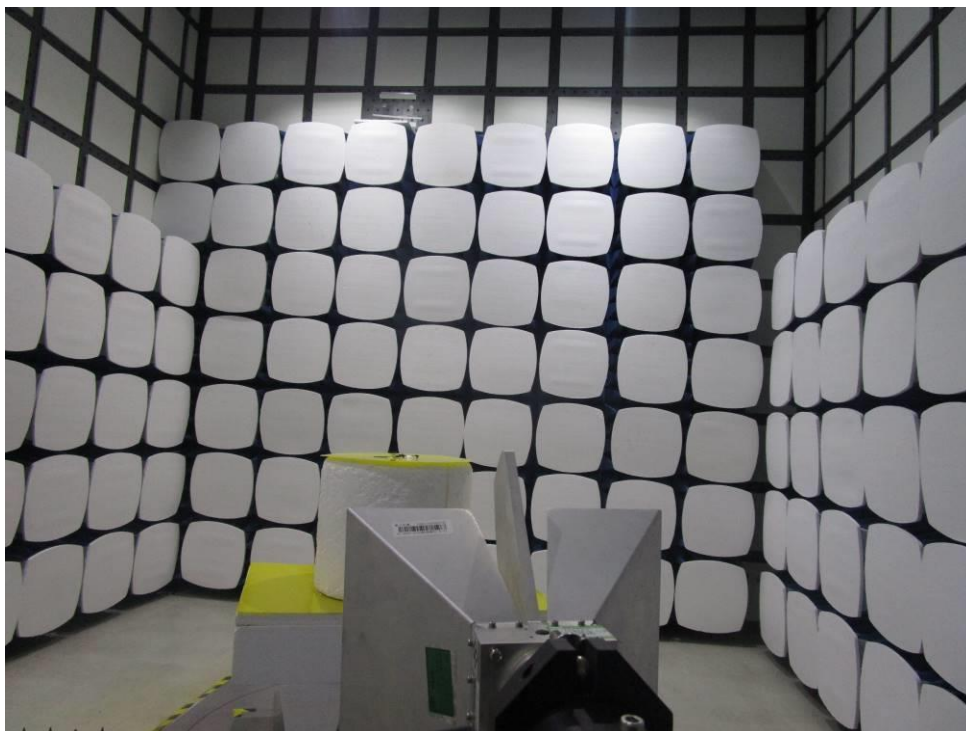
The detailed test data see: Appendix 300328

8 Photographs

8.1 Transmitter unwanted emissions in the spurious domain Test Setup



8.2 Receiver spurious emissions Test Setup





8.3 EUT Constructional Details (EUT Photos)

Refer to Appendix A - Photographs of EUT Constructional Details for SZEM2009009954CR.



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9 Appendix

9.1 Appendix 300328

1.RF Output Power

Test Condition	Test Mode	Test Channel	Ant	Power [dBm]	EIRP [dBm]	Limit [dBm]	Verdict
TNVN	BLE	2402	Ant1	-0.40	-0.89	<=20	PASS
TNVN	BLE	2440	Ant1	-0.46	-0.95	<=20	PASS
TNVN	BLE	2480	Ant1	-1.31	-1.8	<=20	PASS
TLVN	BLE	2402	Ant1	-0.32	-0.81	<=20	PASS
TLVN	BLE	2440	Ant1	-0.58	-1.07	<=20	PASS
TLVN	BLE	2480	Ant1	-1.20	-1.69	<=20	PASS
THVN	BLE	2402	Ant1	-0.26	-0.75	<=20	PASS
THVN	BLE	2440	Ant1	-0.31	-0.8	<=20	PASS
THVN	BLE	2480	Ant1	-1.16	-1.65	<=20	PASS



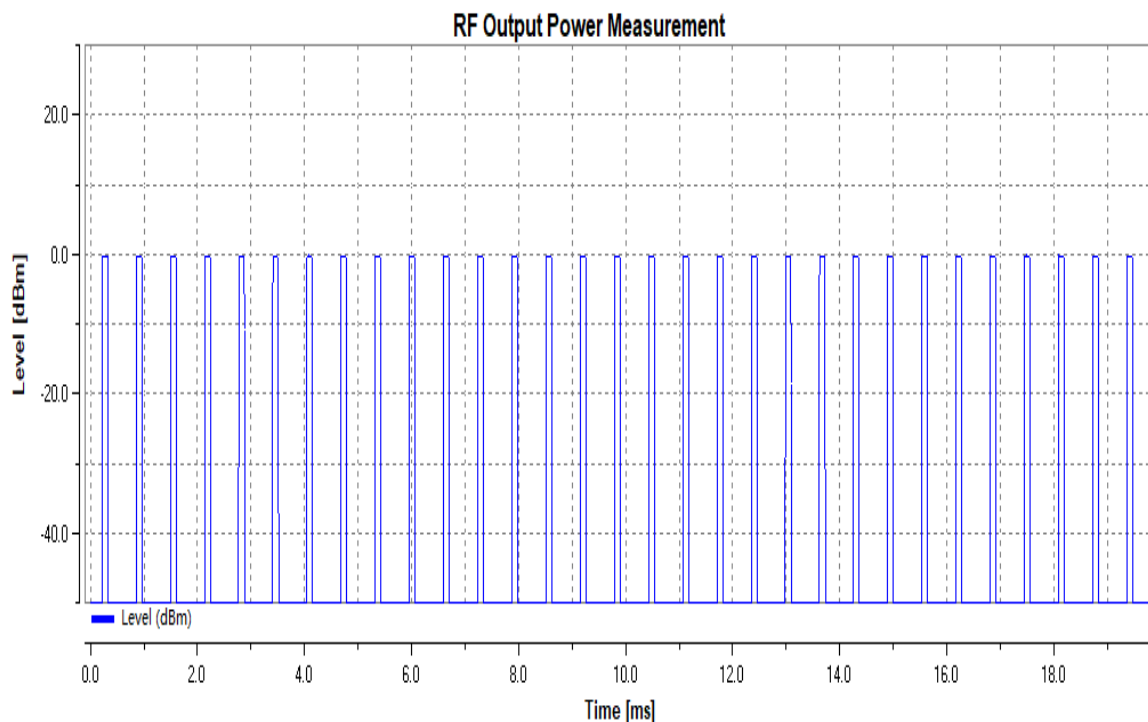
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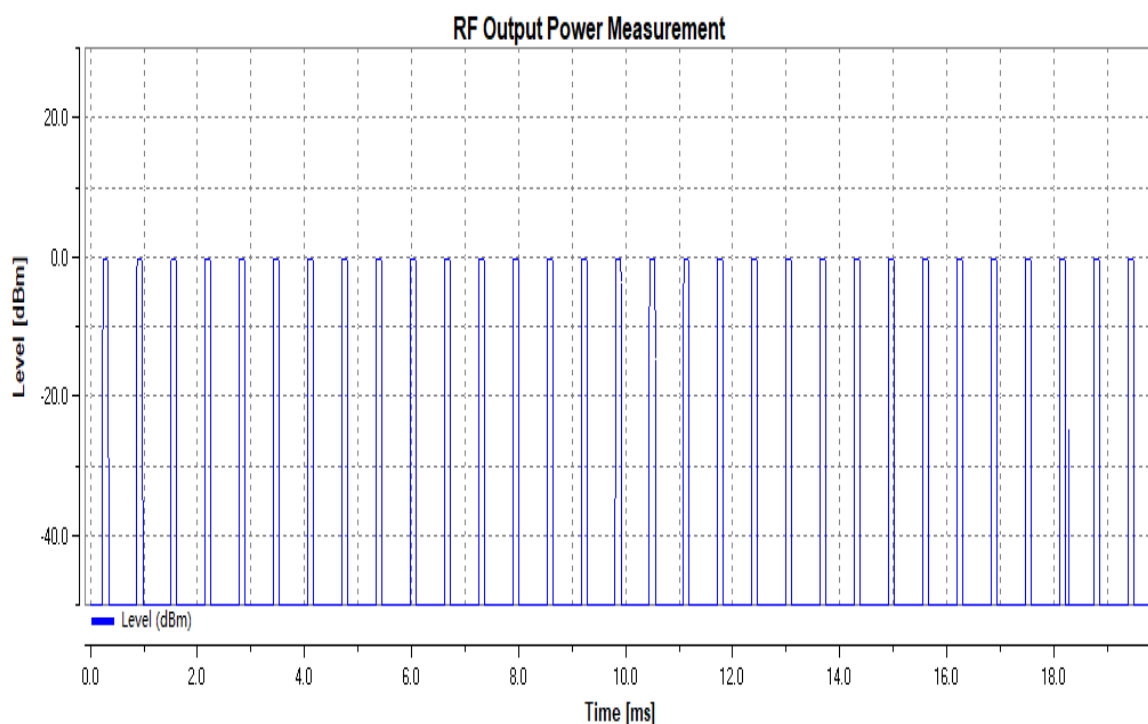
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RF Output Power_TNVN_BLE_2402_Ant1



RF Output Power_TNVN_BLE_2440_Ant1

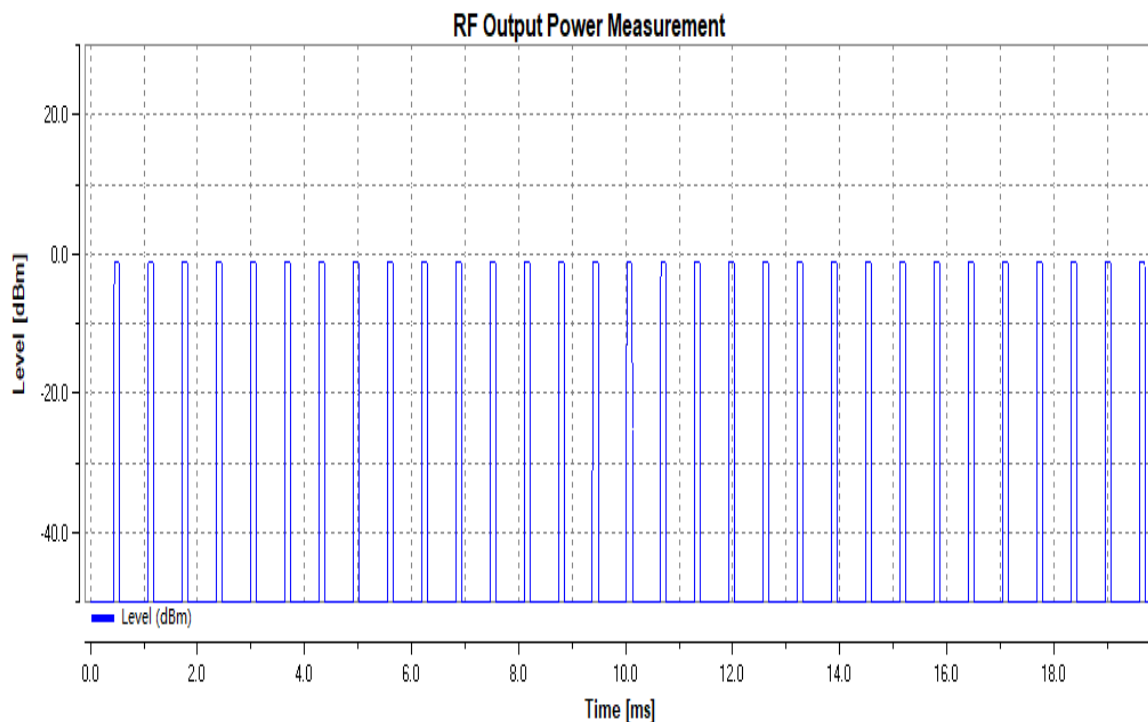


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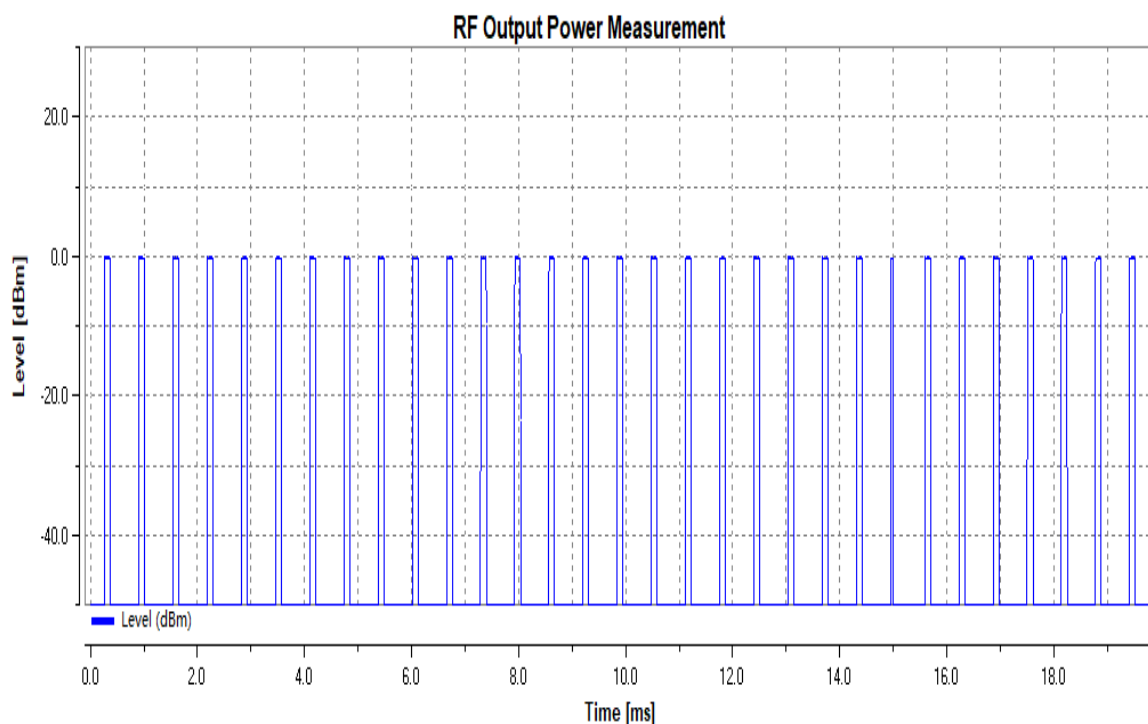
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RF Output Power_TNVN_BLE_2480_Ant1



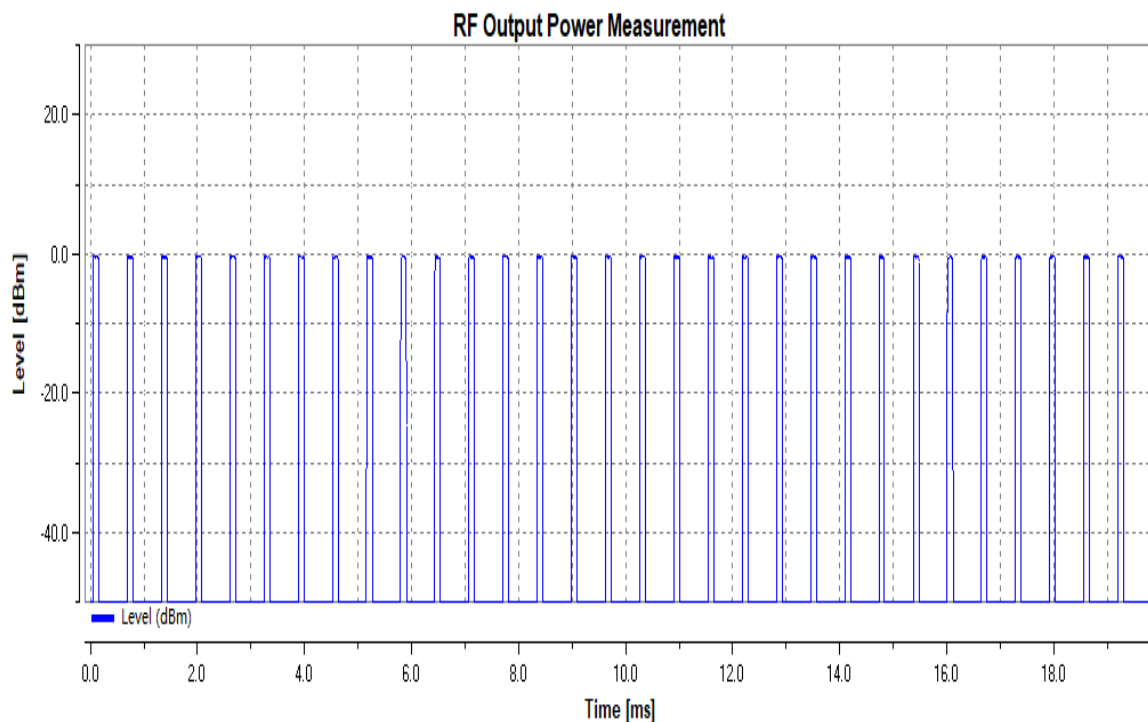
RF Output Power_TLVN_BLE_2402_Ant1



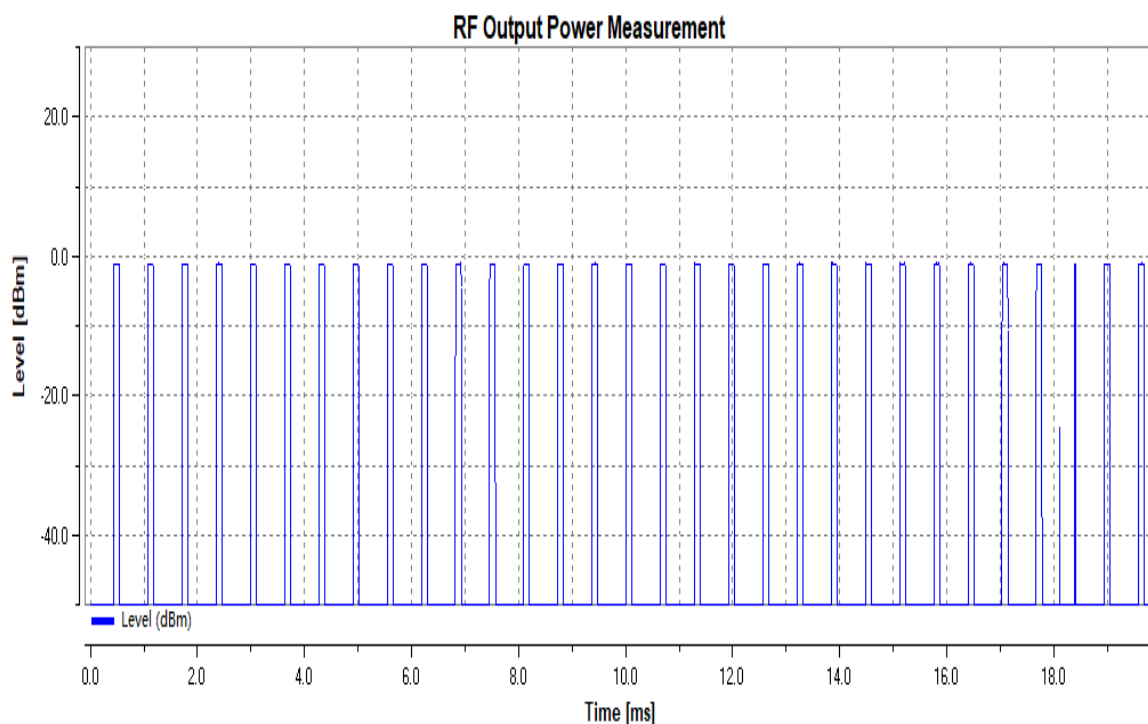
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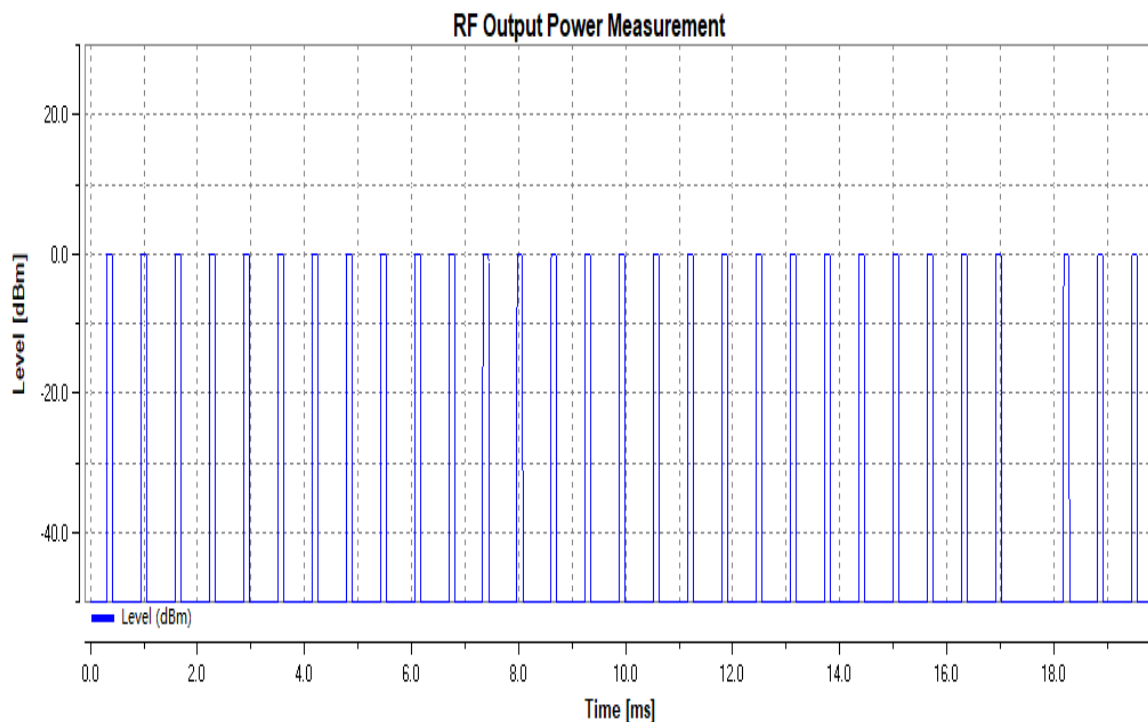
RF Output Power_TLVN_BLE_2440_Ant1



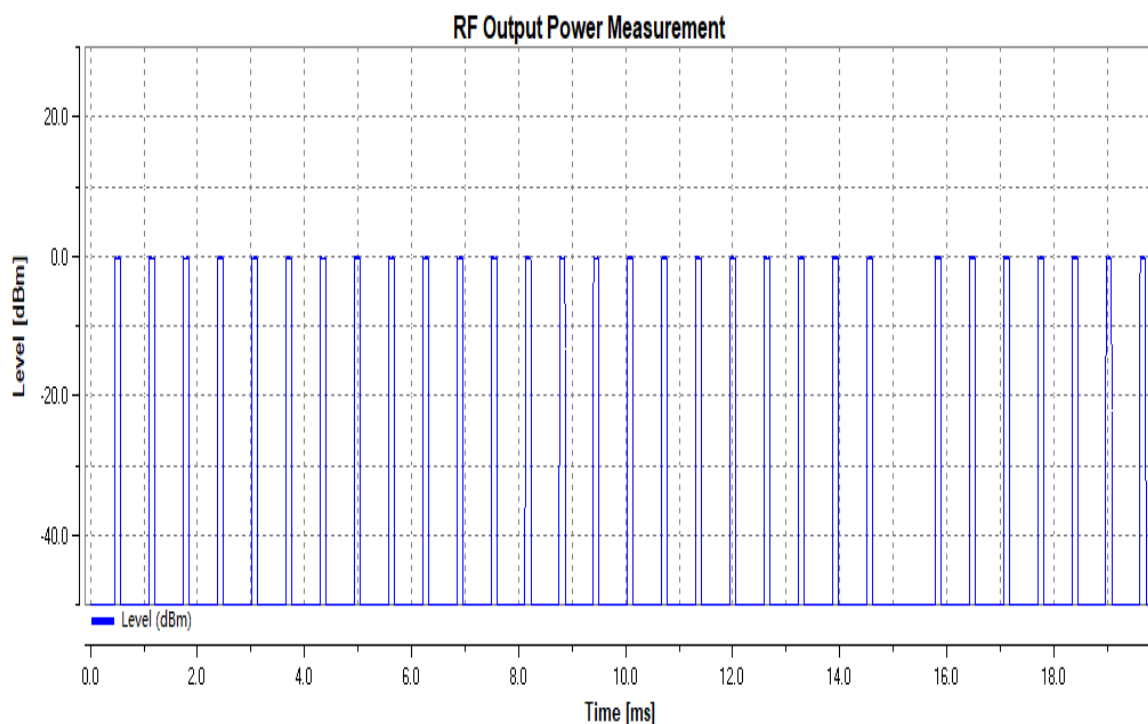
RF Output Power_TLVN_BLE_2480_Ant1

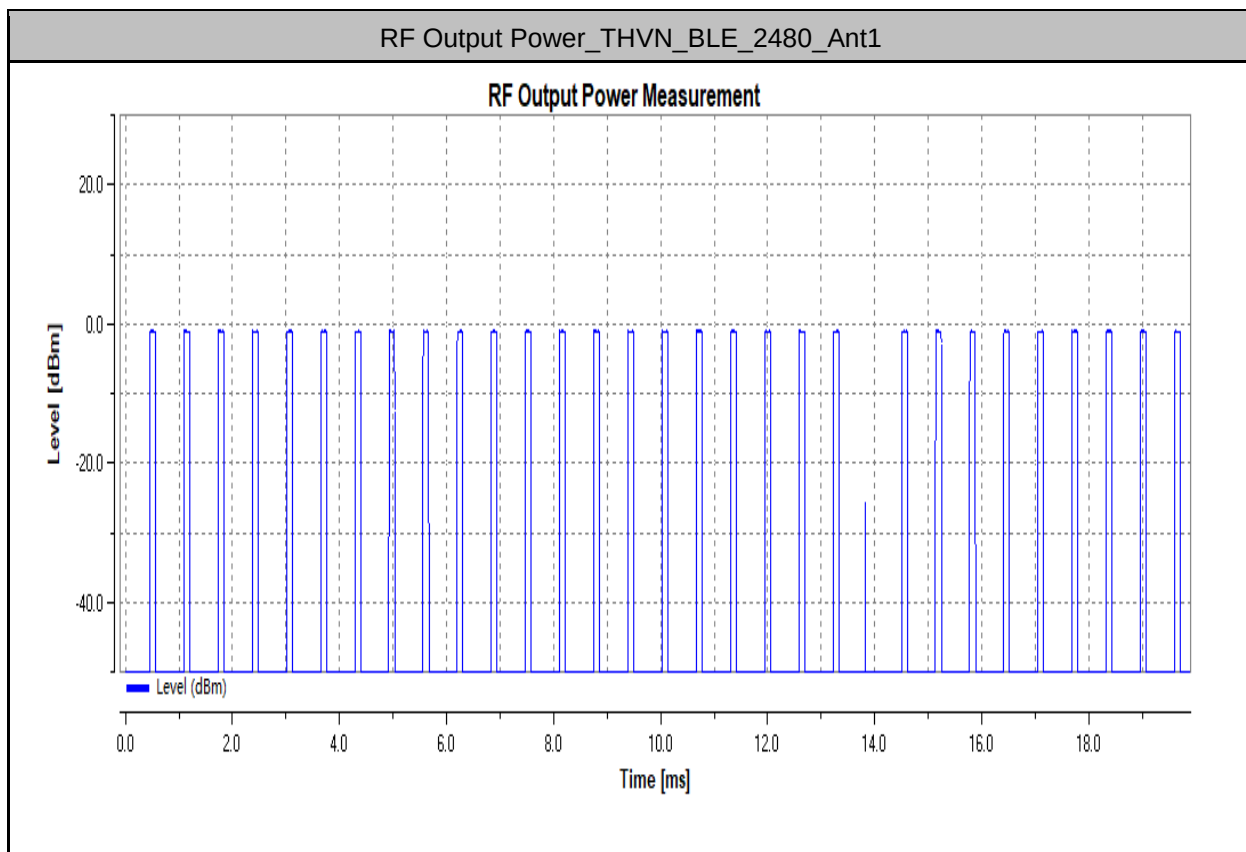


RF Output Power_THVN_BLE_2402_Ant1



RF Output Power_THVN_BLE_2440_Ant1

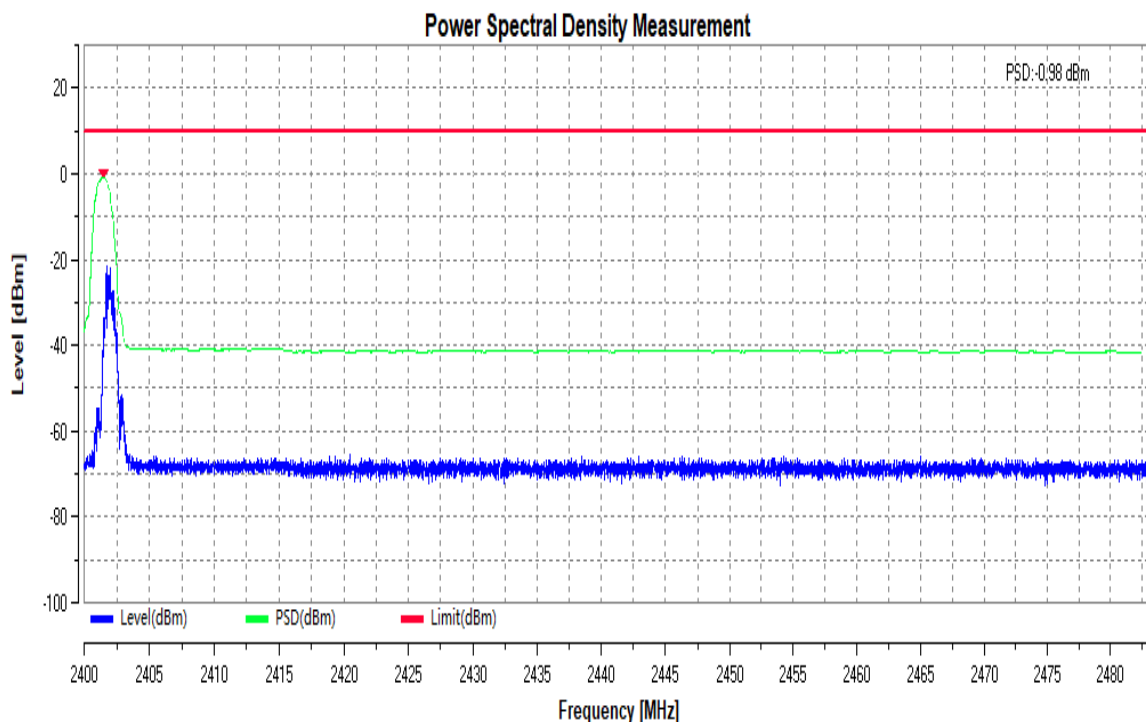




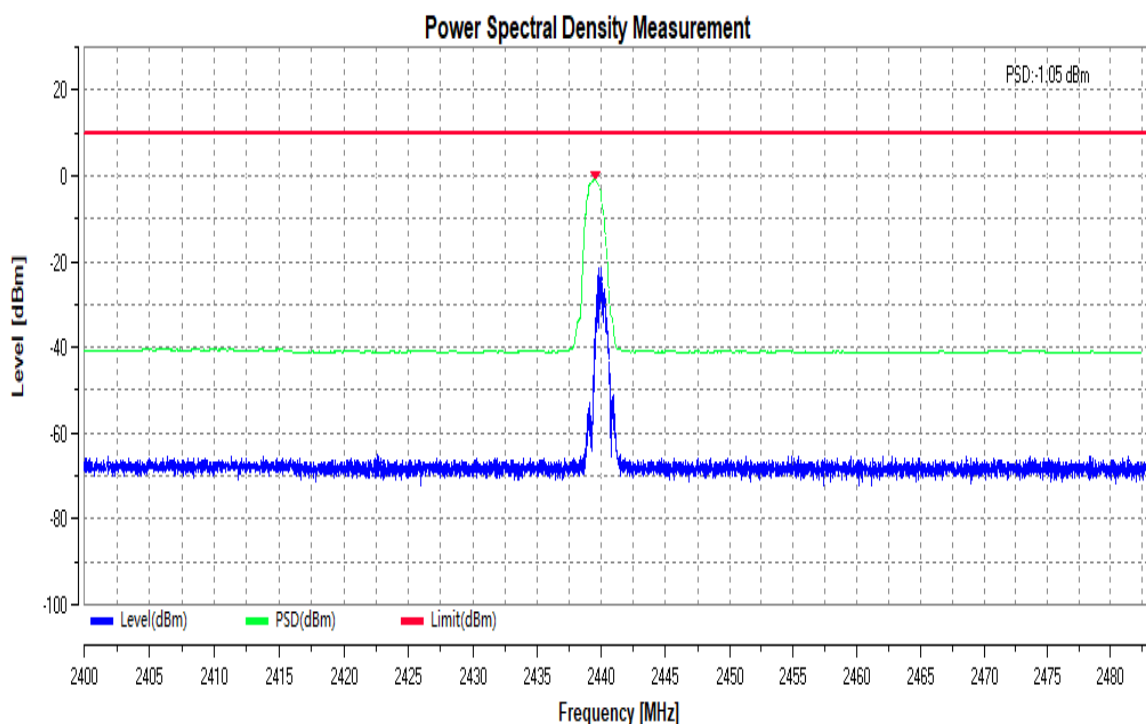
2.Power Spectral Density

Test Condition	Test Mode	Test Channel	Ant	PSD [dBm/MHz]	Limit [dBm/MHz]	Verdict
TNVN	BLE	2402	Ant1	-0.98	<=10	PASS
TNVN	BLE	2440	Ant1	-1.05	<=10	PASS
TNVN	BLE	2480	Ant1	-1.90	<=10	PASS

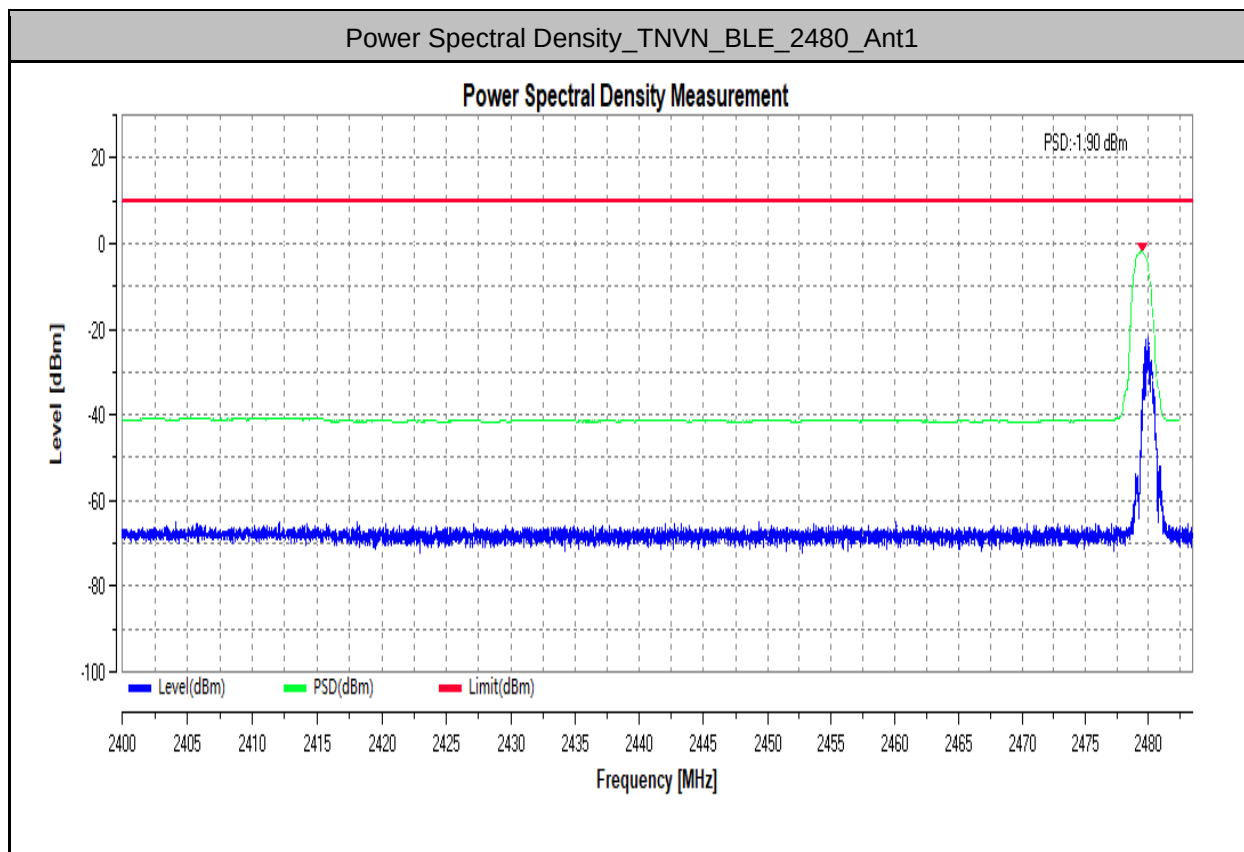
Power Spectral Density_TNVN_BLE_2402_Ant1



Power Spectral Density_TNVN_BLE_2440_Ant1



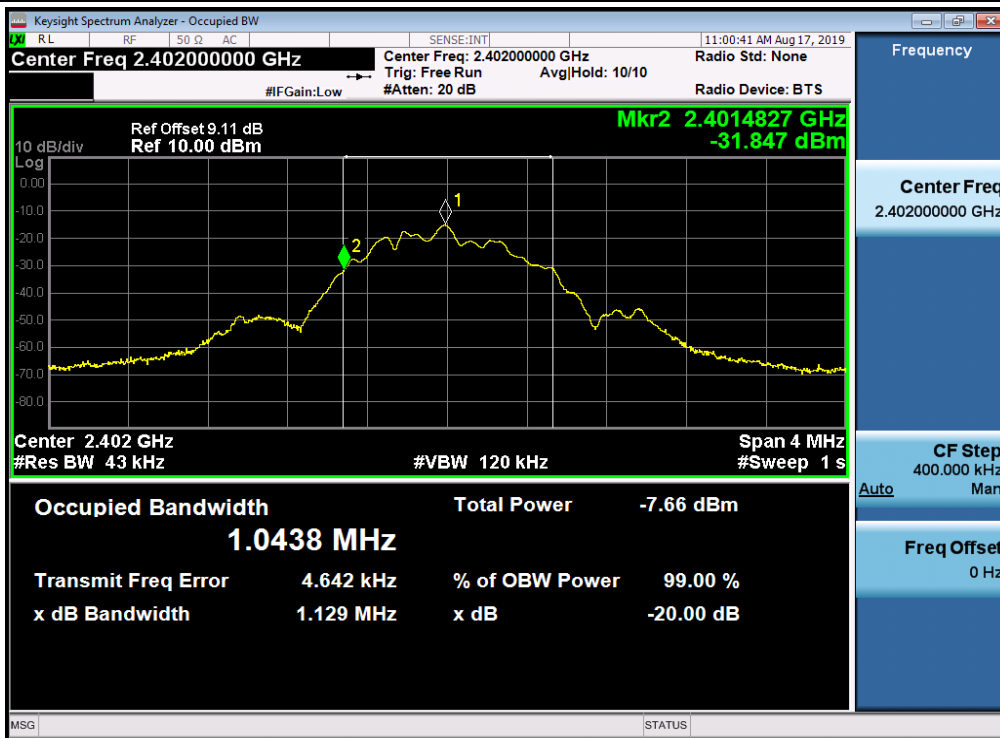
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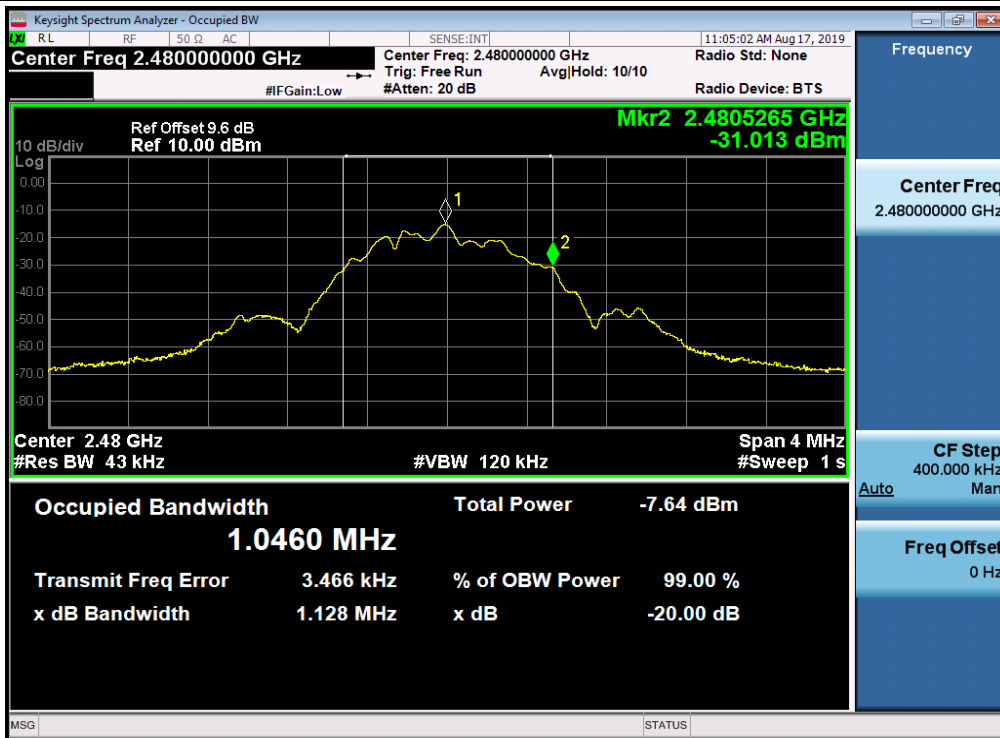
3.Occupied Channel Bandwidth

Test Condition	Test Mode	Test Channel	Ant	OBW [MHz]	FL OBW [MHz]	FH OBW [MHz]	Verdict
TNVN	BLE	2402	Ant1	1.0438	2401.48274	---	PASS
TNVN	BLE	2480	Ant1	1.0460	---	2480.52647	PASS

Occupied Channel Bandwidth_TNVN_BLE_2402_Ant1



Occupied Channel Bandwidth_TNVN_BLE_2480_Ant1



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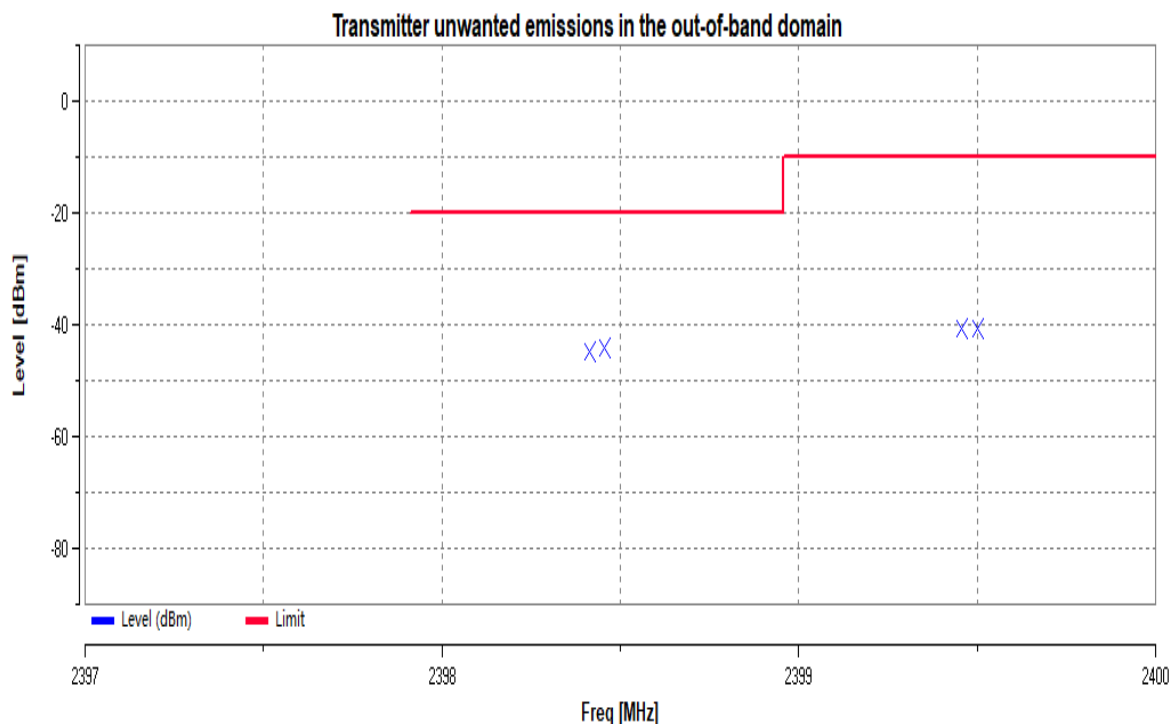


4.Transmitter unwanted emissions in the out-of-band domain

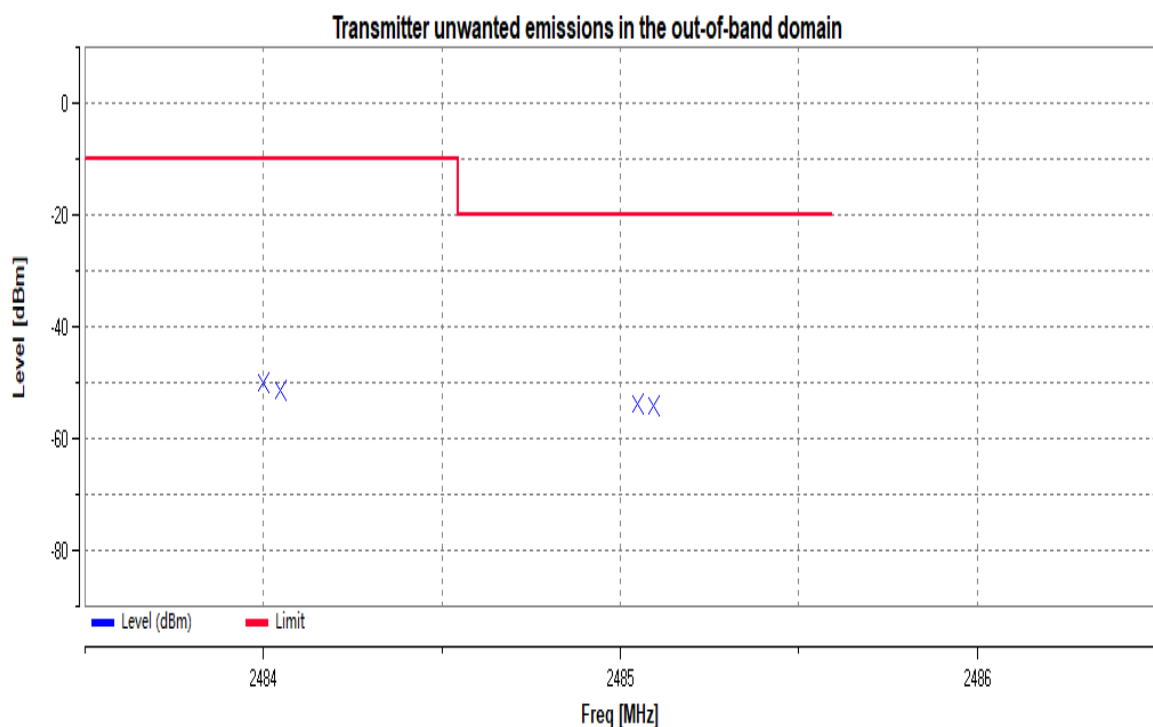
Test Condition	Test Mode	Test Channel	Ant	Freq [MHz]	Result [dBm]	Limit [dBm]	Verdict
TNVN	BLE	2402	Ant1	2398.412	-44.83	<=-20	PASS
TNVN	BLE	2402	Ant1	2398.456	-44.30	<=-20	PASS
TNVN	BLE	2402	Ant1	2399.456	-40.81	<=-10	PASS
TNVN	BLE	2402	Ant1	2399.500	-40.76	<=-10	PASS
TNVN	BLE	2480	Ant1	2484.000	-50.11	<=-10	PASS
TNVN	BLE	2480	Ant1	2484.046	-51.55	<=-10	PASS
TNVN	BLE	2480	Ant1	2485.046	-53.72	<=-20	PASS
TNVN	BLE	2480	Ant1	2485.092	-54.27	<=-20	PASS



TX_OOB_TNVN_BLE_2402_Ant1_2400MHz-2BW to 2400MHz



TX_OOB_TNVN_BLE_2480_Ant1_2483.5MHz to 2483.5MHz+2BW



5.Receiver Blocking

Receiver Category	Test Channel	Pmin (dBm)	Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)	PER (%)	Limit (%)	Result
3	Lowest	-73	Pmin + 12 dB	2380	-57	1.3	10	Pass
				2300	-47	9.2	10	Pass
	Highest	-72	Pmin + 12 dB	2503.5	-57	3.3	10	Pass
				2583.5	-47	8.5	10	Pass

- End of the Report -