Shenzhen CTL Testing Technology Co., Ltd.
Tel: +86-755-89486194 E-mail: ctl@ctl-lab.com

TEST REPORT

ETSI EN 300 328 V1.9.1(2015-02)

Report Reference No. ..... :	**CTL1703042091-WR**	
Compiled by: (position+printed name+signature)	Allen Wang (File administrators)	
Tested by: (position+printed name+signature)	Nice Nong (Test Engineer)	
Approved by: (position+printed name+signature)	Ivan Xie (Manager)	

Product Name..... :	Khadas VIM
Model/Type reference ..... :	VIM
List Model(s)..... :	VIM, VIM Pro
Trade Mark ..... :	Khadas
Applicant's name ..... :	**Shenzhen Wesion Technology Co., Ltd.**
Address of applicant ..... :	C301, Mingyou Caigou Zhongxin, Baoyuan Road, Xixiang, Bao'an, Shenzhen, China
Test Firm ..... :	**Shenzhen CTL Testing Technology Co., Ltd.**
Address of Test Firm ..... :	Floor 1-A, Baisha Technology Park, No.3011, Shahexi Road, Nanshan District, Shenzhen, China 518055
Test specification..... :	
Standard..... :	**ETSI EN 300 328 V1.9.1(2015-02)**
TRF Originator ..... :	Shenzhen CTL Testing Technology Co., Ltd.
Master TRF ..... :	Dated 2011-01
Date of Receipt..... :	Mar. 08, 2017
Date of Test Date..... :	Mar. 09, 2017–Mar. 16, 2017
Data of Issue..... :	Mar. 17, 2017
Result..... :	Pass

TEST REPORT

Test Report No. :	CTL1703042091-WR	Mar. 17, 2017
		Date of issue

Equipment under Test	:	Khadas VIM
Model /Type	:	VIM
Listed Models	:	VIM, VIM Pro
Applicant	:	**Shenzhen Wesion Technology Co., Ltd.**
Address	:	C301, Mingyou Caigou Zhongxin, Baoyuan Road, Xixiang, Bao'an, Shenzhen, China
Manufacturer	:	**Shenzhen Wesion Technology Co., Ltd.**
Address	:	C301, Mingyou Caigou Zhongxin, Baoyuan Road, Xixiang, Bao'an, Shenzhen, China

Test result	Pass *

* In the configuration tested, the EUT complied with the standards specified page 5.

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

** Modified History **

Revision	Description	Issued Data	Report No.	Remark
Version 1.0	Initial Test Report Release	2017-03-17	CTL1703042091-WR	Tracy Qi

Contents

1 TEST SUMMARY 5

1.1 TEST STANDARDS 5
1.2 TEST DESCRIPTION 5
1.3 TEST FACILITY 6
1.4 STATEMENT OF THE MEASUREMENT UNCERTAINTY 6

2 GENERAL INFORMATION 7

2.1 ENVIRONMENTAL CONDITIONS 7
2.2 GENERAL DESCRIPTION OF EUT 7
2.3 DESCRIPTION OF TEST MODES AND TEST FREQUENCY 8
2.4 MEASUREMENT INSTRUMENTS LIST 10

3 TEST ITEM AND RESULTS 11

3.1 RF OUTPUT POWER 11
3.2 POWER SPECTRAL DENSITY 14
3.3 DUTY CYCLE, TX-SEQUENCE, TX-GAP 20
3.4 ACCUMULATED TRANSMIT TIME, FREQUENCY OCCUPATION AND HOPPING SEQUENCE 21
3.5 HOPPING FREQUENCY SEPARATION 27
3.6 MEDIUM UTILISATION (MU) FACTOR 29
3.7 OCCUPIED CHANNEL BANDWIDTH 30
3.8 TRANSMITTER UNWANTED EMISSIONS IN THE OUT-OF-BAND DOMAIN 35
3.9 TRANSMITTER UNWANTED EMISSIONS IN THE SPURIOUS DOMAIN 48
3.10 RECEIVER SPURIOUS EMISSIONS 58
3.11 ADAPTIVITY AND RECEIVER BLOCKING 65

4 TEST SETUP PHOTOS OF THE EUT 70

5 EXTERNAL AND INTERNAL PHOTOS OF THE EUT 71

6 ANNEX E 72

1 TEST SUMMARY

1.1 Test Standards

The tests were performed according to following standards:

ETSI EN 300 328 V1.9.1(2015-02)–Electromagnetic compatibility and Radio spectrum Matters (ERM); Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive.

1.2 Test Description

Item	Reference	Result
Maximum transmit power	ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.1.2 ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.2.2	PASS
Power Spectral Density	ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.2.3	PASS
Duty Cycle, Tx-sequence, Tx-gap	ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.1.3 ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.2.4	N/A_{note1}
Dwell time, Minimum Frequency Occupation and Hopping Sequence	ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.1.4	PASS
Hopping Frequency Separation	ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.1.5	PASS
Medium Utilisation (MU) factor	ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.1.6 ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.2.5	N/A_{note1}
Adaptively	ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.1.7 ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.2.6	PASS
Occupied Channel Bandwidth	ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.1.8 ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.2.7	PASS
Transmitter unwanted emissions in the out-of-band domain	ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.1.9 ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.2.8	PASS
Transmitter unwanted emissions in the spurious domain	ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.1.10 ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.2.9	PASS
Receiver spurious emissions	ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.1.11 ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.2.10	PASS
Receiver Blocking	ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.1.12 ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.2.11	PASS

Note1: This requirement does not apply to adaptive equipment.

1.3 Test Facility

1.3.1 Address of the test laboratory

Shenzhen CTL Testing Technology Co., Ltd.
Floor 1-A, Baisha Technology Park, No. 3011, Shahexi Road, Nanshan, Shenzhen 518055 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 and CISPR 22/EN 55022 requirements.

1.3.2 Laboratory accreditation

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

IC Registration No.: 9618B

The 3m alternate test site of Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration No.: 9618B on November 13, 2013.

FCC-Registration No.: 970318

Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 970318, December 19, 2013.

1.4 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen CTL Testing Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for CTL laboratory is reported:

Test Items	Measurement Uncertainty	Notes
Occupied Channel Bandwidth	±2%	(1)
Transmitter power conducted	0.57 dB	(1)
Transmitter power Radiated	2.20 dB	(1)
Conducted spurious emission	1.60 dB	(1)
Radiated spurious emission	2.20 dB	(1)
Temperature	±1℃	(1)
Humidity	±3%	(1)
DC and low frequency voltages	±1.5%	(1)
Time	±2%	(1)
Duty cycle	±2%	(1)

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

2 GENERAL INFORMATION

2.1 Environmental conditions

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

Temperature	Normal Temperature:	25°C
	High Temperature:	55°C
	Low Temperature:	-20°C
Voltage	Normal Voltage	230V
	High Voltage	254V
	Low Voltage	207V
Other	Relative Humidity	55 %
	Air Pressure	101 kPa

2.2 General Description of EUT

Product Name:	Khadas VIM
Model/Type reference:	VIM, VIM Pro
Power supply:	USB 5V from PC
WIFI	
Supported type:	802.11b/802.11g/802.11n(H20)
Modulation:	802.11b: DSSS 802.11g/802.11n(H20): OFDM
Operation frequency:	802.11b/802.11g/802.11n(H20): 2412MHz~2472MHz
Channel number:	802.11b/802.11g/802.11n(H20): 13
Channel separation:	5MHz
Antenna type:	FPC Antenna
Antenna gain:	0dBi
Bluetooth 3.0	
Version:	Supported BT 3.0
Modulation:	GFSK, π/4DQPSK, 8DPSK
Operation frequency:	2402MHz~2480MHz
Channel number:	79
Channel separation:	1MHz
Antenna type:	FPC Antenna
Antenna gain:	0dBi

Bluetooth BLE	
Supported type:	Version 4.0 for low Energy
Modulation:	GFSK
Operation frequency:	2402MHz to 2480MHz
Channel number:	40
Channel separation:	2 MHz
Antenna type:	FPC Antenna
Antenna gain:	0dBi

Note: For more detailed features description, please refer to the manufacturer's specifications or the User's Manual or Annex E

2.3 Description of Test Modes and Test Frequency

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.

Operation Frequency List WIFI：

Channel	Frequency(MHz)	Channel	Frequency(MHz)
1	**2412**	8	2447
2	2417	9	2452
3	2422	10	2457
4	2427	11	2462
5	2432	12	2467
6	2437	**13**	**2472**
7	**2442**		

Operation Frequency List BT3.0：

Channel	Frequency (MHz)
00	**2402**
01	2403
⋮	⋮
38	2440
39	**2441**
40	2442
⋮	⋮
77	2479
78	**2480**

Operation Frequency List BT4.0：

Channel	Frequency (MHz)
00	**2402**
01	2404
02	2406
⋮	⋮

19	**2440**
⋮	⋮
37	2476
38	2478
39	**2480**

Note: The line display in grey were the channel selected for testing

2.4 Measurement Instruments List

RF output power & PSD & OOB & OBW & Hoping & Duty Cycle, Tx-sequence, Tx-gap & Adaptively						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
1	Spectrum Analyzer	Agilent	N9020	US46220290	2017/01/16	2018/01/17
2	Signal Generator	Agilent	N5182A	MY47420864	2016/05/21	2017/05/20
3	Signal Generator	Agilent	E4421B	US40051744	2016/05/21	2017/05/20
4	Power Sensor	Agilent	U2021XA	MY5365004	2016/05/21	2017/05/20
5	Power Meter	Agilent	U2531A	TW53323507	2016/05/21	2017/05/20
6	Climate Chamber	ESPEC	EL-10KA	A20120523	2016/05/20	2017/05/19

Transmitter spurious emissions & Receiver spurious emissions						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
1	ULTRA-ROADBAND ANTENNA	Sunol Sciences Corp.	JB1	A061713	2016/06/02	2017/06/01
2	Horn Antenna	Sunol Sciences Corp.	DRH-118	A062013	2016/05/19	2017/05/18
3	EMI Test Receiver	R&S	ESCI	103710	2016/06/02	2017/06/01
4	Controller	EM Electronics	Controller EM 1000	N/A	2016/05/21	2017/05/20
5	Amplifier	Agilent	8349B	3008A02306	2016/05/19	2017/05/18
6	Amplifier	Agilent	8447D	2944A10176	2016/05/19	2017/05/18
7	Temperature/Humidity Meter	Gangxing	CTH-608	02	2016/05/20	2017/05/19
8	High-Pass Filter	K&L	9SH10-2700/X12750-O/O	N/A	2016/05/20	2017/05/19
9	High-Pass Filter	K&L	41H10-1375/U12750-O/O	N/A	2016/05/20	2017/05/19
10	RF Cable	HUBER+SUHNER	RG214	N/A	2016/05/20	2017/05/19

The calibration interval is 1 year.

3 TEST ITEM AND RESULTS

3.1 RF Output Power

Limit

ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.1.2.3 & Sub-clause 4.3.2.2.3

TEST CONDITION	LIMIT
Normal and Extreme	20dBm(e.i.r.p)

Test Procedure

- Step 1: Use a fast power sensor suitable for 2,4 GHz and capable of minimum 1 MS/s. Use the following settings:
  - Sample speed 1 MS/s or faster.
  - The samples shall represent the RMS power of the signal.
  - Measurement duration: For non-adaptive equipment: equal to the observation period defined in clause 4.3.1.3.2 or clause 4.3.2.4.2. For adaptive equipment, the measurement duration shall be long enough to ensure a minimum number of bursts (at least 10) are captured.

NOTE 1: For adaptive equipment, to increase the measurement accuracy, a higher number of bursts may be used.

- Step 2:For conducted measurements on devices with one transmit chain:

  -Connect the power sensor to the transmit port, sample the transmit signal and store the raw data. Use these stored samples in all following steps.

For conducted measurements on devices with multiple transmit chains:

- Connect one power sensor to each transmit port for a synchronous measurement on all transmits ports.
- Trigger the power sensors so that they start sampling at the same time. Make sure the time difference between the samples of all sensors is less than 500 ns.
- For each individual sampling point (time domain), sum the coincident power samples of all ports and store them. Use these summed samples in all following steps.

- Step 3: Find the start and stop times of each burst in the stored measurement samples.

  The start and stop times are defined as the points where the power is at least 30 dB below the highest value of the stored samples in step 2.

NOTE 2: In case of insufficient dynamic range, the value of 30 dB may need to be reduced appropriately.

- Step 4: Between the start and stop times of each individual burst calculate the RMS power over the burst using the formula below. Save these P_{burst} values, as well as the start and stop times for each burst.

$$P_{burst} = \frac{1}{k} \sum_{n=1}^{k} P_{sample}(n)$$

With 'k' being the total number of samples and 'n' the actual sample number

- Step 5: The highest of all P_{burst} values (value "A" in dBm) will be used for maximum e.i.r.p. calculations.
- Step 6: Add the (stated) antenna assembly gain "G" in dBi of the individual antenna. If applicable, add the additional beamforming gain "Y" in dB using the formula below:

P = A + G + Y

Test Results

WIFI

802.11b mode							
Test conditions		Channel	Measured power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Result
Voltage (V)	Temperature (℃)						
230V	25	CH01	14.39	0.00	14.39	20.00	Pass
		CH07	14.49	0.00	14.49		
		CH13	14.57	0.00	14.57		
	-20	CH01	14.44	0.00	14.44		
		CH07	14.56	0.00	14.56		
		CH13	14.57	0.00	14.57		
	+55	CH01	14.29	0.00	14.29		
		CH07	14.38	0.00	14.38		
		CH13	14.44	0.00	14.44		

802.11g mode							
Test conditions		Channel	Measured power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Result
Voltage (V)	Temperature (℃)						
230V	25	CH01	13.66	0.00	13.66	20.00	Pass
		CH07	13.54	0.00	13.54		
		CH13	13.97	0.00	13.97		
	-20	CH01	13.54	0.00	13.54		
		CH07	13.23	0.00	13.23		
		CH13	13.74	0.00	13.74		
	+55	CH01	13.56	0.00	13.56		
		CH07	13.63	0.00	13.63		
		CH13	13.55	0.00	13.55		

802.11n(H20) mode							
Test conditions		Channel	Measured power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Result
Voltage (V)	Temperature (℃)						
230V	25	CH01	13.11	0.00	13.11	20.00	Pass
		CH07	13.04	0.00	13.04		
		CH13	13.23	0.00	13.23		
	-20	CH01	13.24	0.00	13.24		
		CH07	13.51	0.00	13.51		
		CH13	13.32	0.00	13.32		
	+55	CH01	13.25	0.00	13.25		
		CH07	13.15	0.00	13.15		
		CH13	13.19	0.00	13.19		

Note 1. We captured 25 bursts for each mode and recorded the maximum average power
2. Measured Power includes the cable loss.

BT3.0

GFSK Modulation						
Test conditions		Measured power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Result
Voltage (V)	Temperature (℃)					
230V	25	3.12	0.00	3.12	20.00	Pass
	-20	3.41	0.00	3.41		
	+55	3.26	0.00	3.26		

π/4DQPSK Modulation						
Test conditions		Measured power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Result
Voltage (V)	Temperature (℃)					
230V	25	2.88	0.00	2.88	20.00	Pass
	-20	2.96	0.00	2.96		
	+55	2.74	0.00	2.74		

8DPSK Modulation						
Test conditions		Measured power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Result
Voltage (V)	Temperature (℃)					
230V	25	2.10	0.00	2.10	20.00	Pass
	-20	2.24	0.00	2.24		
	+55	2.18	0.00	2.18		

Note 1. Test performed at worst case at DH5, 2DH5, 3DH5 hoping mode separately.
2. We captured 25 bursts for each mode and recorded the maximum average power.
3. Measured Power includes the cable loss.

BT 4.0

GFSK							
Test conditions		Channel	Measured power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Result
Voltage (V)	Temperature (℃)						
230V	25	CH00	3.25	0.00	3.25	20.00	Pass
		CH19	3.36	0.00	3.36		
		CH39	3.29	0.00	3.29		
	-20	CH00	3.27	0.00	3.27		
		CH19	3.36	0.00	3.36		
		CH39	3.66	0.00	3.66		
	+55	CH00	3.87	0.00	3.87		
		CH19	4.01	0.00	4.01		
		CH39	3.35	0.00	3.35		

Note 1. We captured 25 bursts in total and recorded the maximum average power.
2. Measured Power includes the cable loss.

3.2 Power Spectral Density

Limit

ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.2.3.3

TEST CONDITION	LIMIT
Normal	10dBm / MHz

Remark: Power Spectral Density is not applicable to HFSS system device.

Test Procedure

Step 1: Connect the UUT to the spectrum analyzer and use the following settings:

Start Frequency:	2 400 MHz
Stop Frequency:	2 483,5 MHz
Resolution BW:	10 kHz
Video BW:	30 kHz
Sweep Points:	> 8 350
Detector:	RMS
Trace Mode:	Max Hold
Sweep time:	10 s

- **Step 2:** Add up the values for power for all the samples in the file using the formula below:

$$P_{Sum} = \sum_{n=1}^{k} P_{sample}(n)$$

with 'k' being the total number of samples and 'n' the actual sample number

- **Step 3:** Normalize the individual values for power (in dBm) so that the sum is equal to the RF Output Power (e.i.r.p.) measured and save the corrected data. The following formulas used:

$$C_{Corr} = P_{Sum} - P_{e.i.r.p.}$$

$$P_{Samplecorr}(n) = P_{Sample}(n) - C_{Corr}$$

with 'n' being the actual sample number

- **Step 4:** Starting from the first sample $P_{Samplecorr(n)}$ (lowest frequency), add up the power (in mW) of the following samples representing a 1 MHz segment and record the results for power and position (i.e. sample #1 to sample #100). This is the Power Spectral Density (e.i.r.p.) for the first 1 MHz segment and recorded.
- **Step 5:** Shift the start point of the samples added up in step 4 by one sample and repeat the procedure in step 4 (i.e. sample #2 to sample #101).
- **Step 6:** Repeat step 5 until the end of the data set and record the Power Spectral Density values for each of the 1 MHz segments.
- **Step 7:** For smart antenna systems repeat the measurement for each of the transmit ports. For each sampling point (frequency domain), add up the coincident power values (in mW) for the different transmit chains.
- **Step 8:** Record the highest value of the maximum Power Spectral Density for the UUT and compare it with the limit.

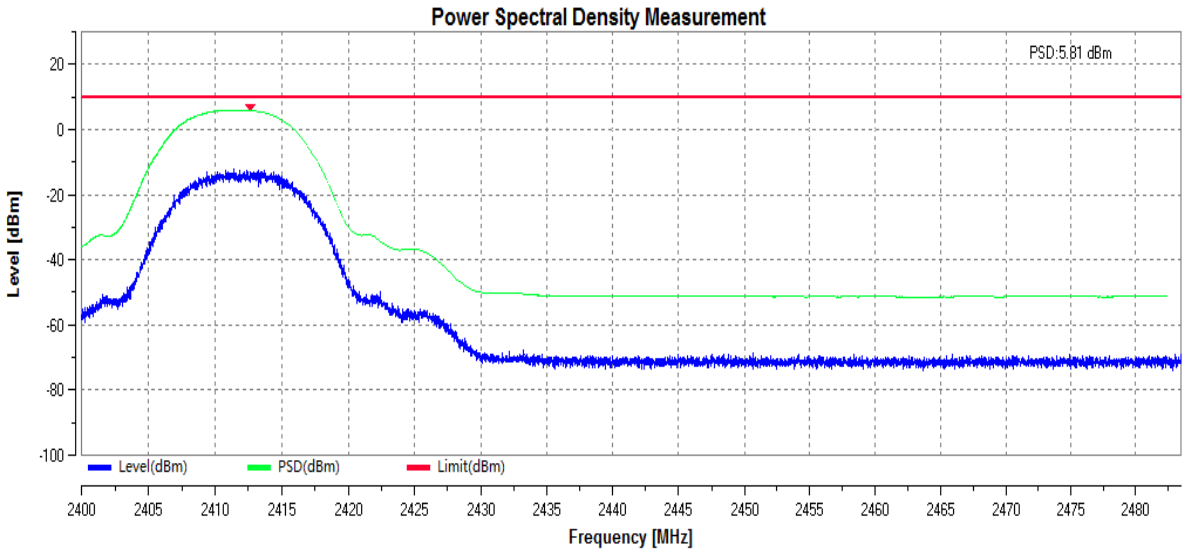
Test Result

Mode	Channel	Measured value (dBm/MHz)	Limit (dBm/MHz)	Result
802.11b	CH01	5.81	10.00	Pass
	CH07	5.98		
	CH13	6.10		
802.11g	CH01	2.32		
	CH07	2.99		
	CH13	2.49		
802.11n(H20)	CH01	1.09		
	CH07	1.29		
	CH13	1.34		

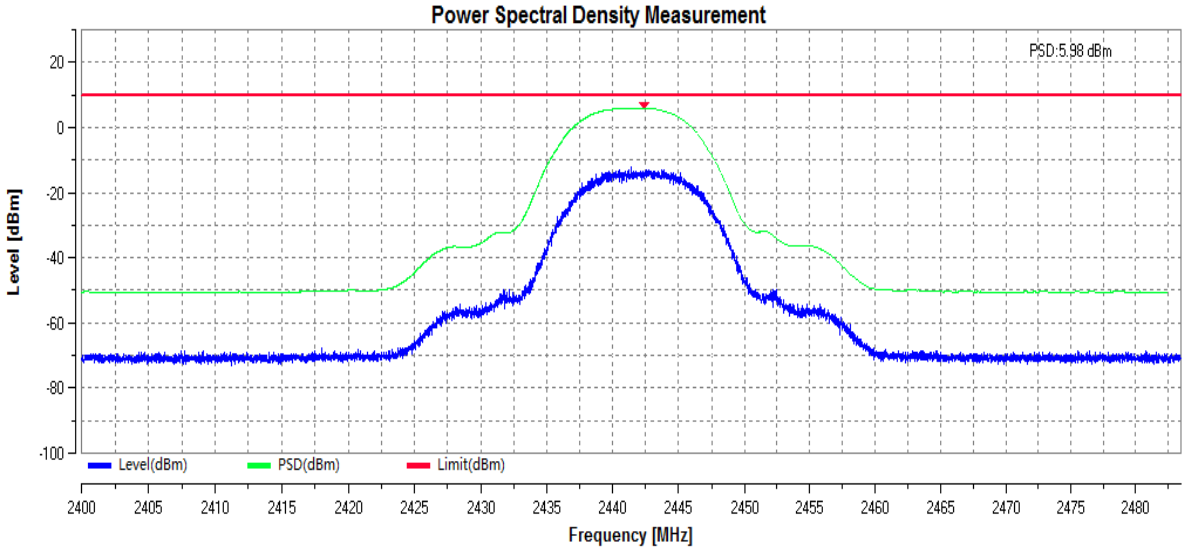
BT4.0				
Mode	**Channel**	**Measured value (dBm/MHz)**	**Limit (dBm/MHz)**	**Result**
GFSK	CH00	5.01	10.00	Pass
	CH19	5.22		
	CH39	4.58		

The test plots as follow:

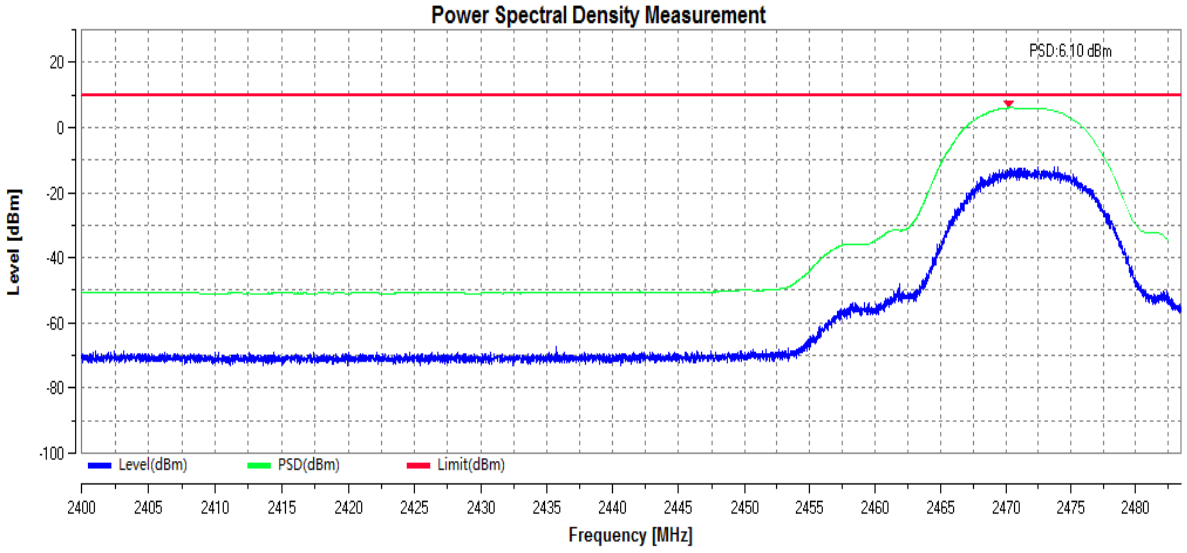
802.11b



CH01

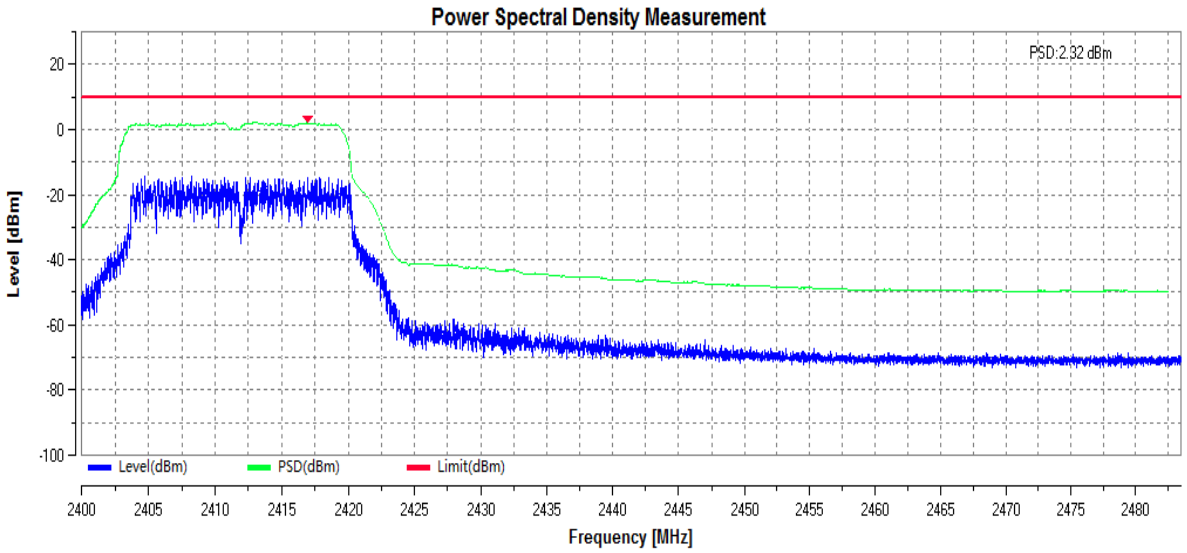


CH07

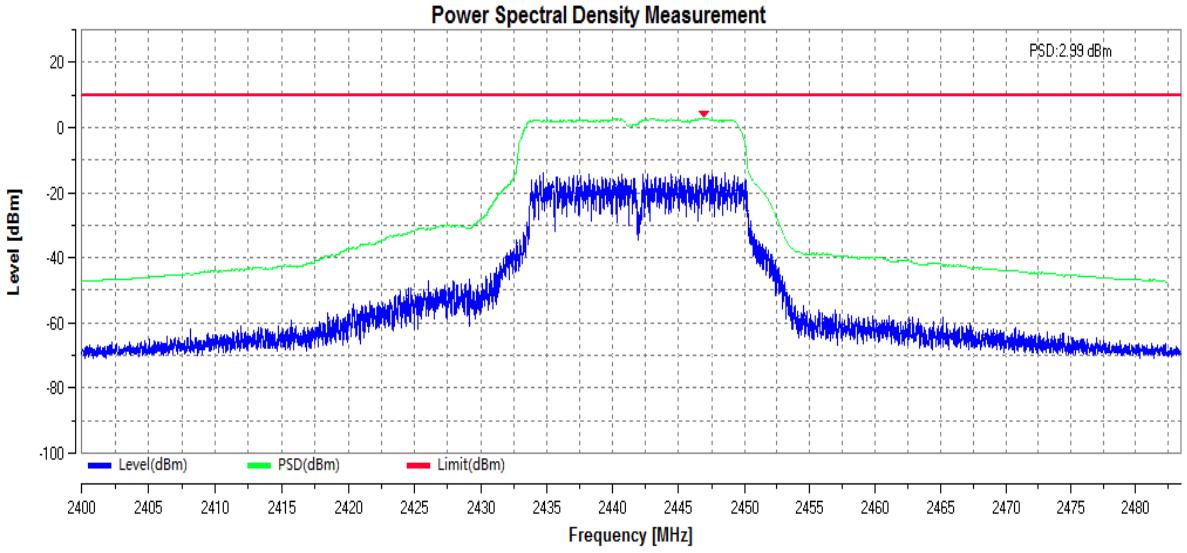


CH13

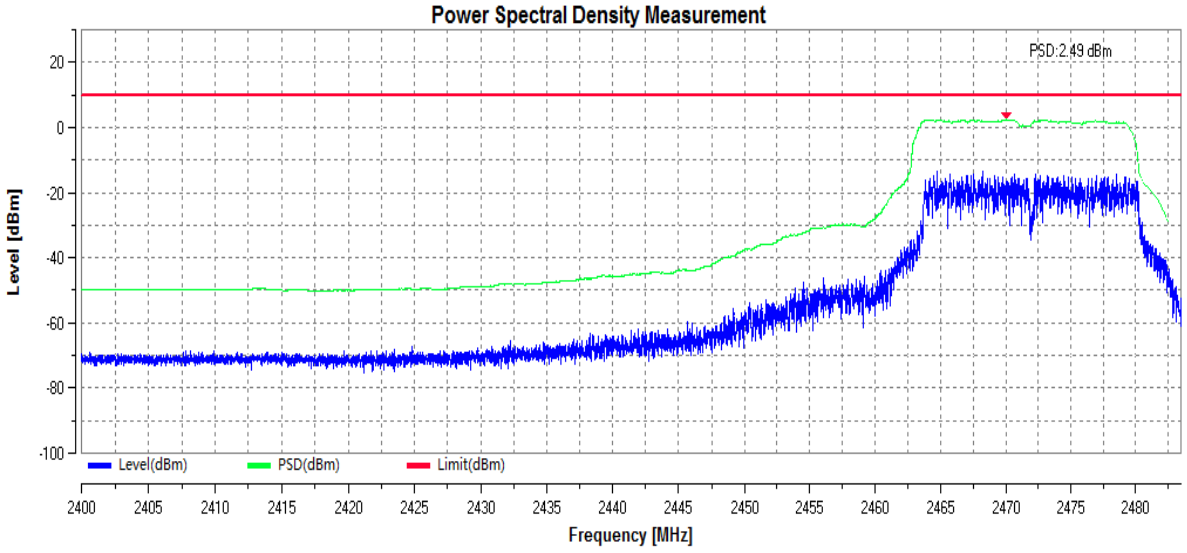
802.11g



CH01

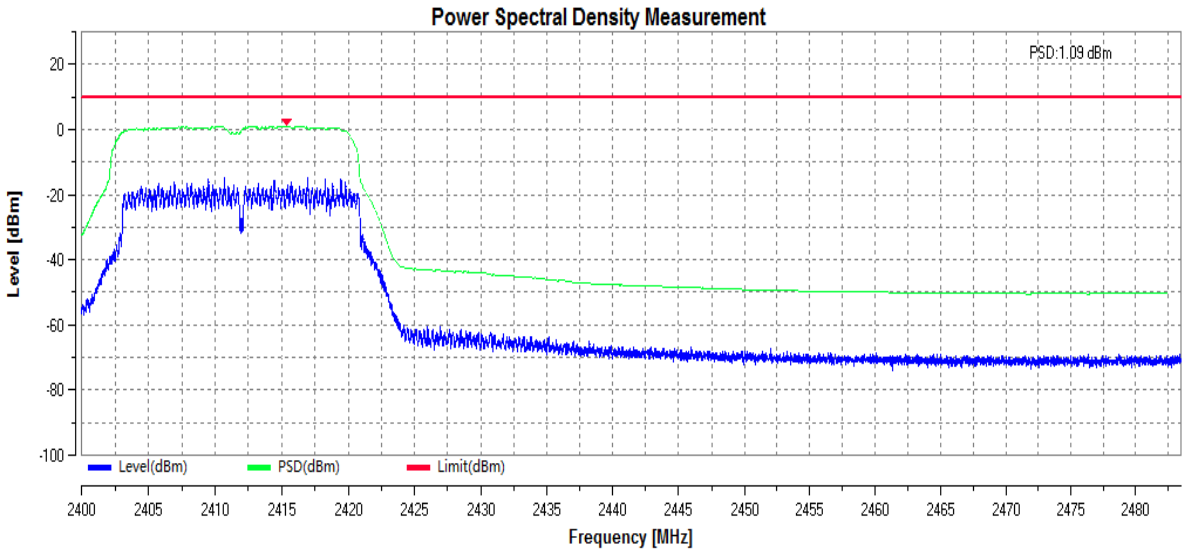


CH07

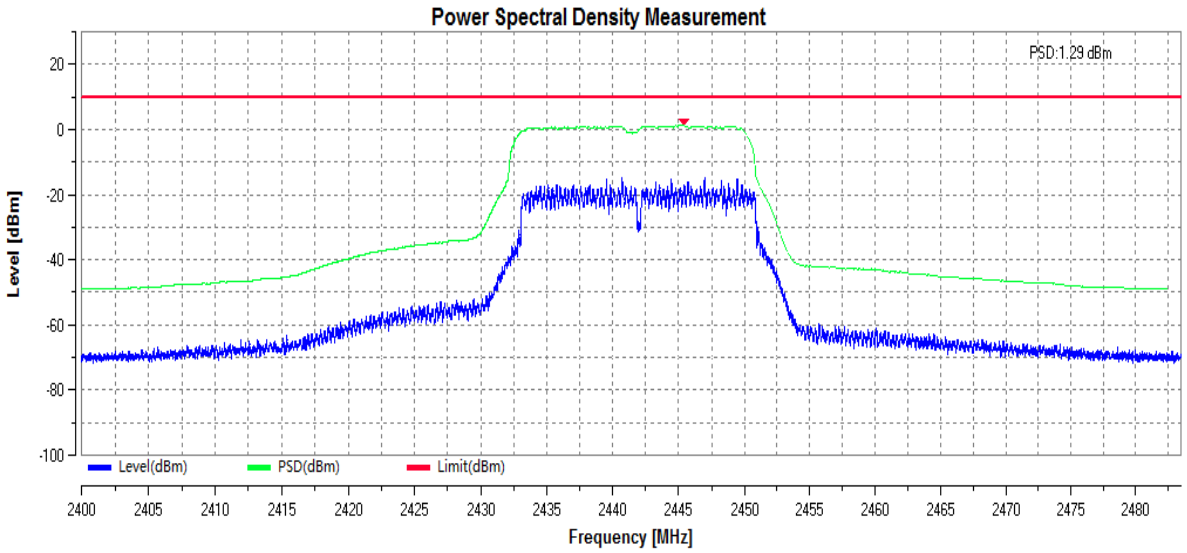


CH13

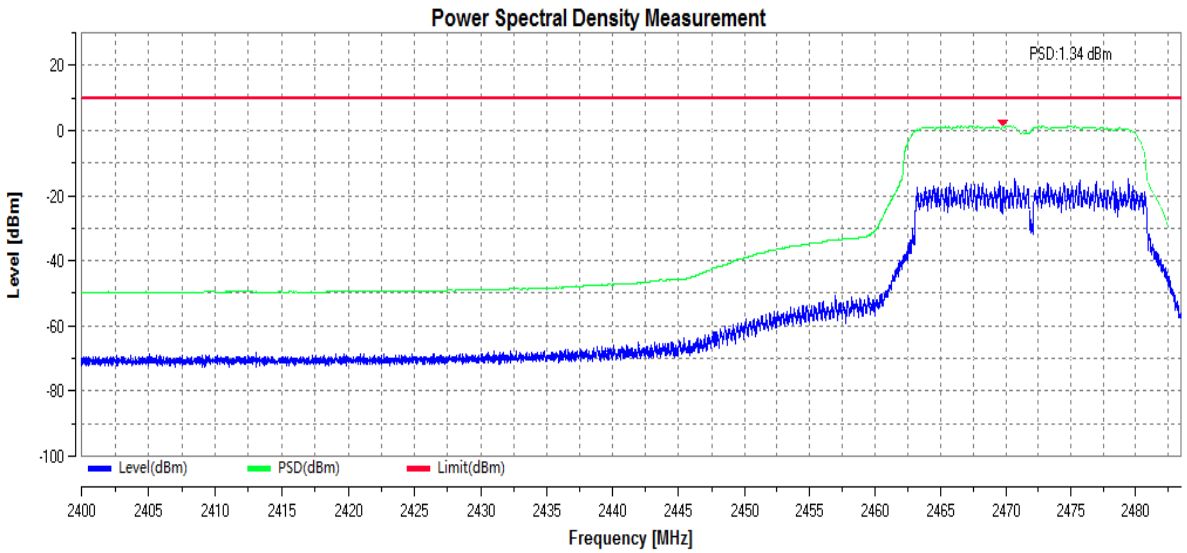
802.11n(HT20)



CH01

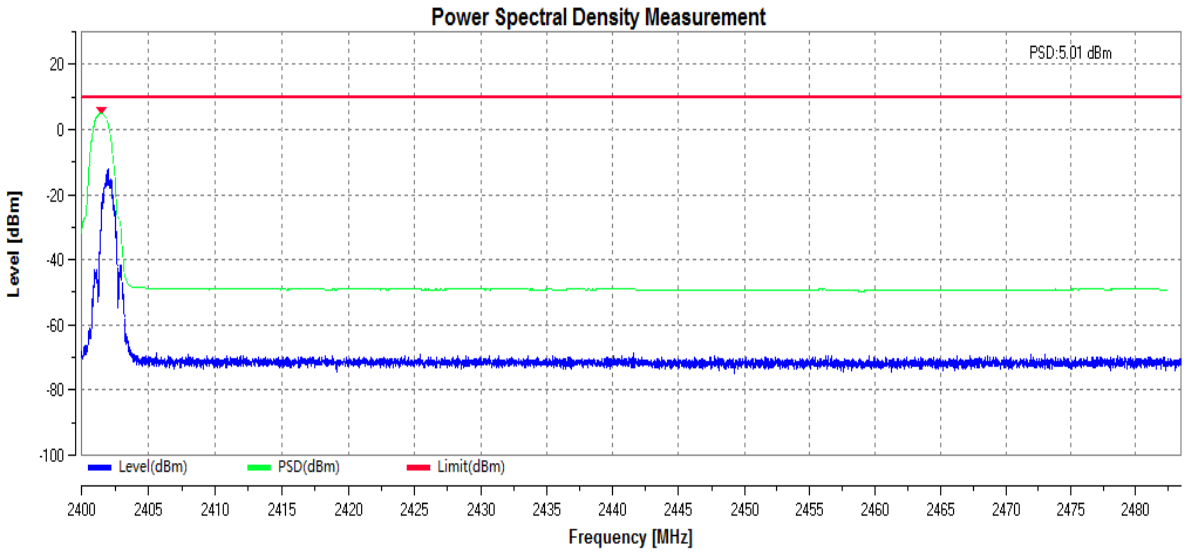


CH07

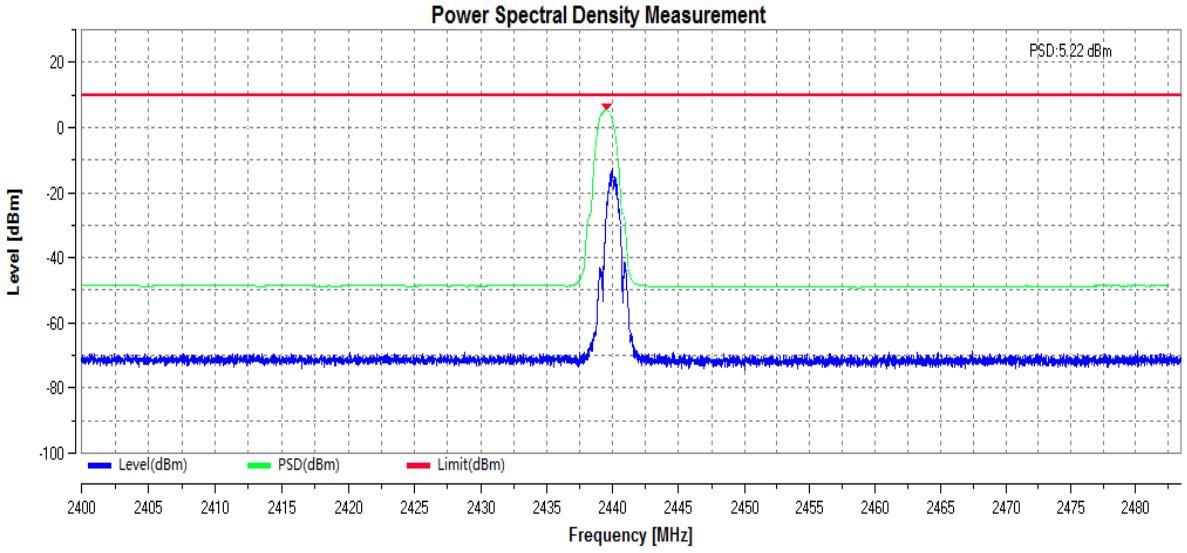


CH13

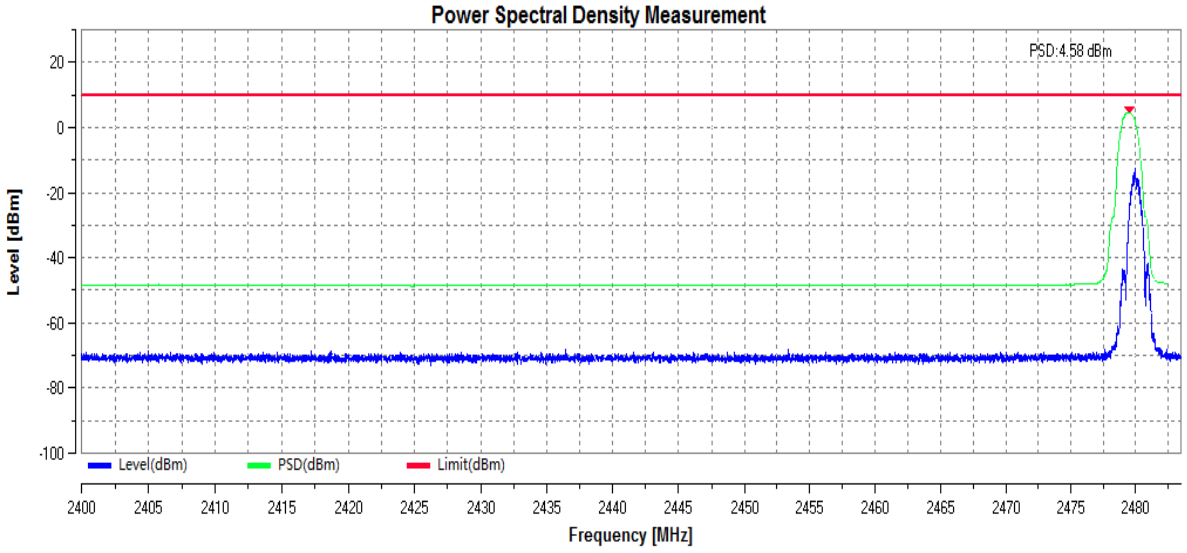
BT4.0



CH00



CH19



CH39

3.3 Duty Cycle, Tx-sequence, Tx-gap

Limit

ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.1.3.3 & 4.3.2.4.3

1. For non-adaptive FHSS equipment, the Duty Cycle shall be equal to or less than the maximum value declared by the supplier. In addition, the maximum Tx -sequence time shall be 5 ms while the minimum Tx-gap time shall be 5 ms.
2. For equipment using wide band modulations other than FHSS, the Duty Cycle shall be equal to or less than the maximum value declared by the supplier.
   The Tx-sequence time shall be equal to or less than 10 ms. The minimum Tx-gap time following a Tx-sequence shall be equal to the duration of that proceeding Tx-sequence with a minimum of 3,5 ms.

Test Procedure

The test procedure, which shall only be performed for non-adaptive systems, shall be as follows:

- **Step 1:** Use the same stored measurement samples from the procedure described in RF output power measurement
- **Step 2:** Between the saved start and stop times of each individual burst, calculate the TxOn time. Save these TxOn values.
- **Step 3:** Al TxOn times between the end of the first gap (which is the start of the first burst within the observation period) and the start of the last burst (within this observation period) divided by the observation period.
- **Step 4:**

  Identify any TxOff time that is equal to or greater than the minimum Tx-gap time. These are the potential valid gap times to be further considered in this procedure.

  Starting from the second identified gap, calculate the time from the start of this gap to the end of the preceding ap. This time is the Tx-sequence time for this transmission. Repeat this procedure until the last identified gap ithin the observation period is reached.

Test Results

Not applicable to this device which was adaptive equipment and cannot operate in a non-adaptive mode.

3.4 Accumulated Transmit Time, Frequency Occupation and Hopping Sequence

LIMIT

ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.1.4.3.

Limit of Accumulated Transmit Time

TEST CONDITION	LIMIT
Non-adaptive frequency hopping systems	≥15 ms within 5ms*hopping frequencies (N)
Adaptive frequency hopping systems	≥0.4s within 0.4s*hopping frequencies (N)

Limit of Minimum Frequency Occupation

TEST CONDITION	LIMIT
Non-adaptive frequency hopping systems Adaptive frequency hopping systems	Option 1: Each hopping frequency of the hopping sequence shall be occupied at least once within a period not exceeding four times the product of the dwell time and the number of hopping frequencies in use. Option 2: The occupation probability for each frequency shall be between ((1 / U) × 25 %) and 77 % where U is the number of hopping frequencies in use.

Hopping Sequence

TEST CONDITION	LIMIT
Non-adaptive frequency hopping systems Adaptive frequency hopping systems	The hopping sequence(s) shall contain at least N hopping frequencies at all times, where N is 15 or 15 divided by the minimum Hopping Frequency Separation in MHz, whichever is the greater. Adaptive Frequency Hopping equipment shall be capable of operating over a minimum of 70 % of the authorized band.

Remark: This test item is not applicable to DSSS/OFDM system device.

Test Procedure

1. The measurement shall be performed on a minimum of 2 hopping frequencies chosen arbitrary from the actual hopping sequence. The results as well as the frequencies on which the test was performed shall be recorded in the test report.
2. The analyzer shall be set as follows:

Centre Frequency:	Equal to the hopping frequency being investigated
Frequency Span:	0 Hz
RBW:	~ 50 % of the Occupied Channel Bandwidth
VBW:	≥ RBW
Detector Mode:	RMS
Sweep time:	400 ms × Minimum number of hopping frequencies (N)
Number of sweep points:	30 000
Trace mode:	Clear / Write
Trigger:	Free Run

3. Indentify the data points related to the frequency being investigated by applying a threshold.

4. Count the number of data points identified as resulting from transmissions on the frequency being investigated and multiply this number by the time difference between two consecutive data points.
5. Record this value as Accumulated Transmit Time in test report.
6. Set Sweep time to 4 × Dwell Time × Actual numbers of hopping frequencies in use and repeat 3 and 4 to get Frequency Occupation Time and Number.
7. Make the following changes on the analyzer for Hopping Sequence measurement

Centre Frequency:	Equal to the hopping frequency being investigated
Start Frequency:	2 400 MHz
Stop Frequency:	2 483,5 MHz
RBW:	~ 50 % of the Occupied Channel Bandwidth (single hop)
VBW:	≥ RBW
Detector Mode:	RMS
Sweep time:	1 s
Number of sweep points:	30 000
Trace mode:	Max Hold
Trigger:	Free Run

8. When the trace has completed, indentify the number of hopping frequencies used by the hopping sequence.
9. For adaptive systems, using the lowest and highest -20 dB points from the total spectrum envelope obtained instep 7, it shall be verified whether the system uses 70 % of the authorized band. The result shall be recorded in the test report.

Test Results

Test performed at all modulation type and recorded worst case at DH5, 2DH5, and 3DH5.

◆ **Accumulated Transmit Time**

The test period: T= 0.4s*hopping frequencies (N)=0.4*15=6s

Channel	Modulation	Accumulated Transmit Time (ms)	Limit (ms)	Result
CH00	GFSK	65.200	400	Pass
	π/4QPSK	68.400	400	Pass
	8DPSK	59.600	400	Pass
CH78	GFSK	50.800	400	Pass
	π/4QPSK	56.600	400	Pass
	8DPSK	65.600	400	Pass

◆ **Frequency Occupation**

The test period: T= 4 × Dwell Time × Actual number of hopping frequencies=4*3.75*79=1185ms

Channel	Modulation	Frequency occupation times (s)	Frequency occupation Number (pcs)	Limit (pcs)	Result
CH00	GFSK	17.420	6	≥1	Pass
	π/4QPSK	20.303	7		Pass
	8DPSK	20.343	7		Pass
CH78	GFSK	17.420	6		Pass
	π/4QPSK	11.534	4		Pass
	8DPSK	14.497	4		Pass

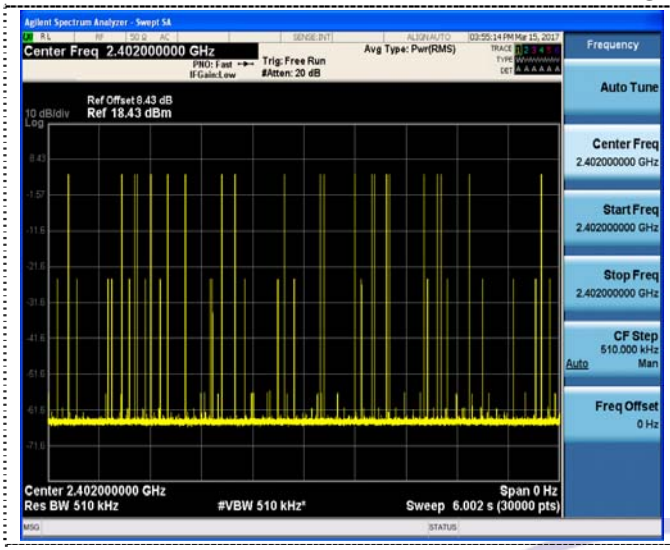
◆ **Hopping Sequence**

Modulation	Number of Hopping Channel	Limit	-20 dB Bandwidth (%)	Limit	Result
GFSK	79	≥15	95.44	70 % of the band 2400MHz-2483.5MHz	Pass
π/4QPSK	79		95.95		
8DPSK	79		95.95		

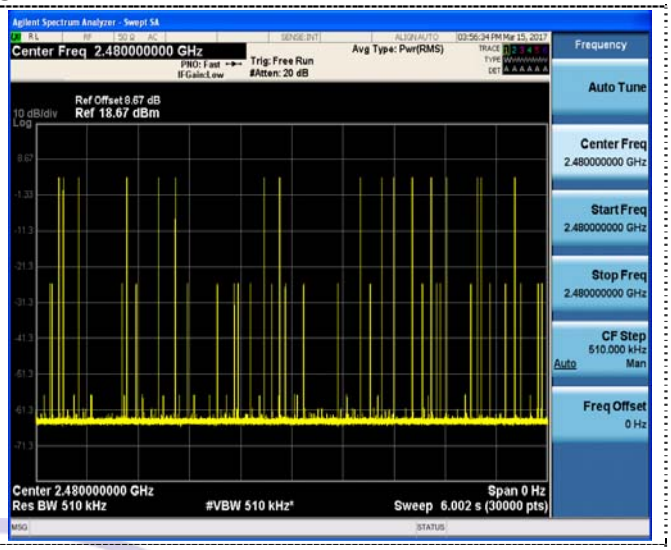
Test plot as follows:

Accumulated Transmit Time

GFSK

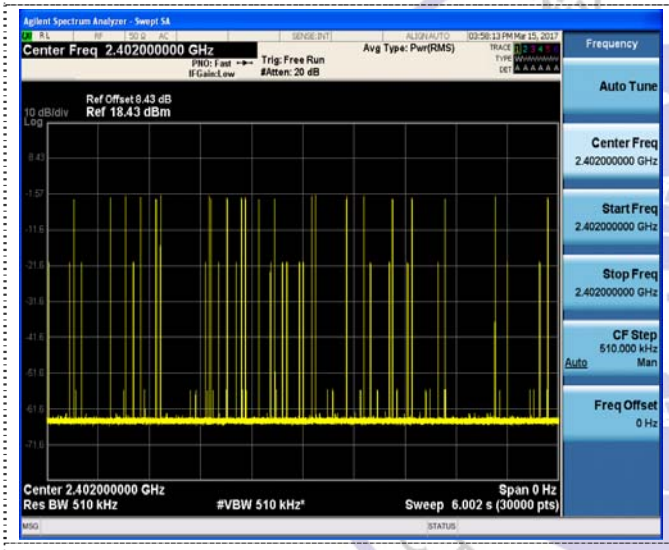


CH00

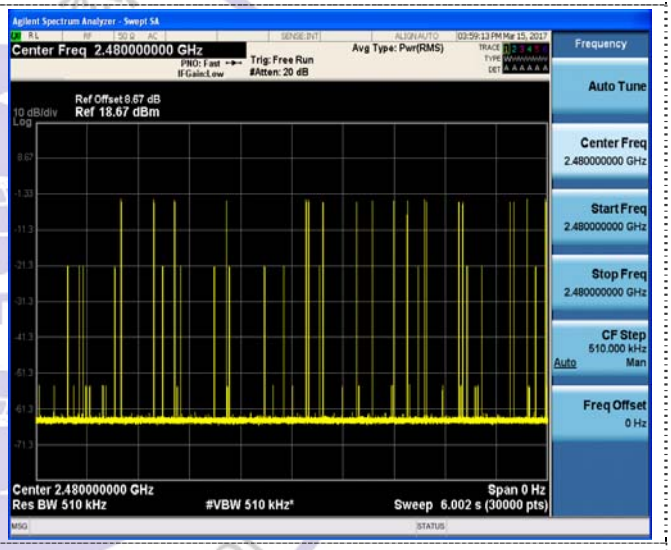


CH78

π/4QPSK

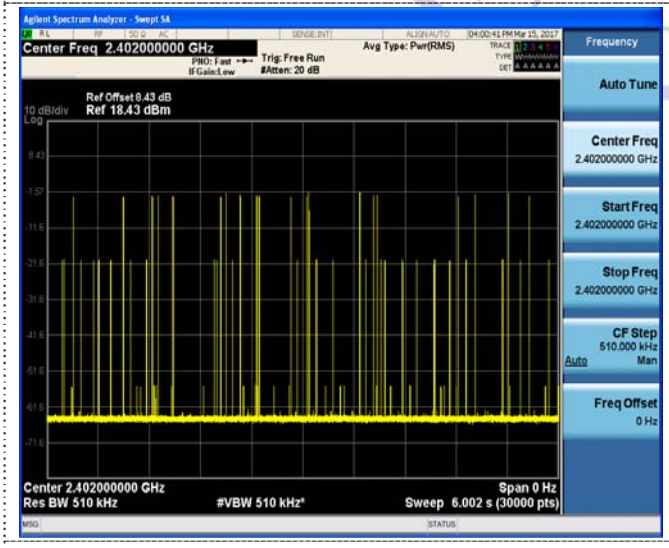


CH00

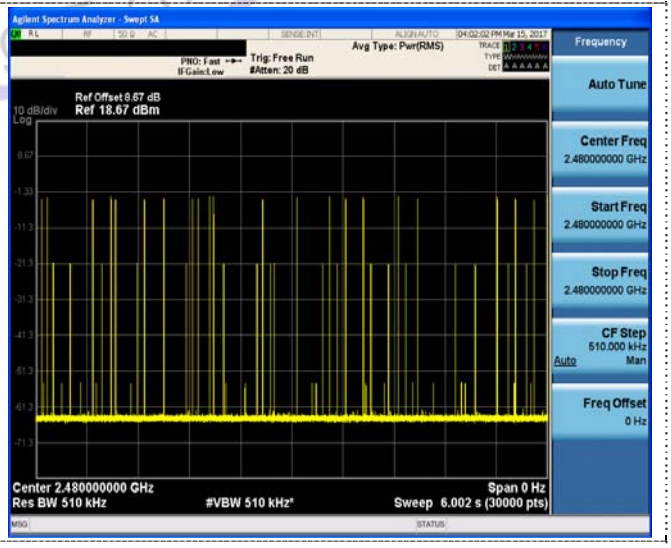


CH78

8DPSK



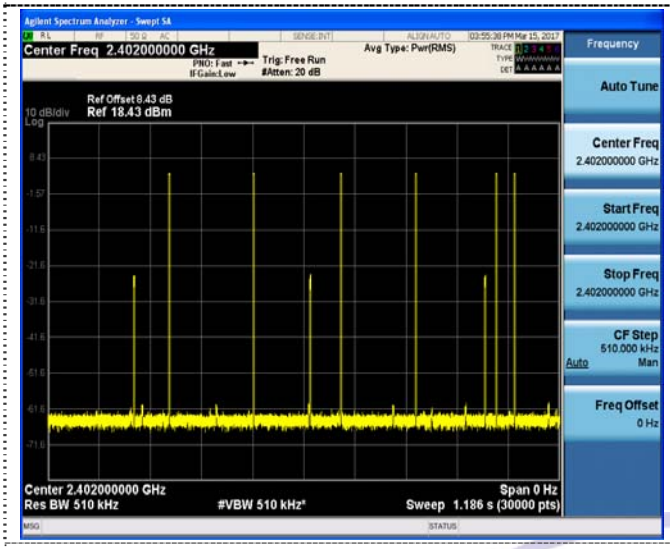
CH00



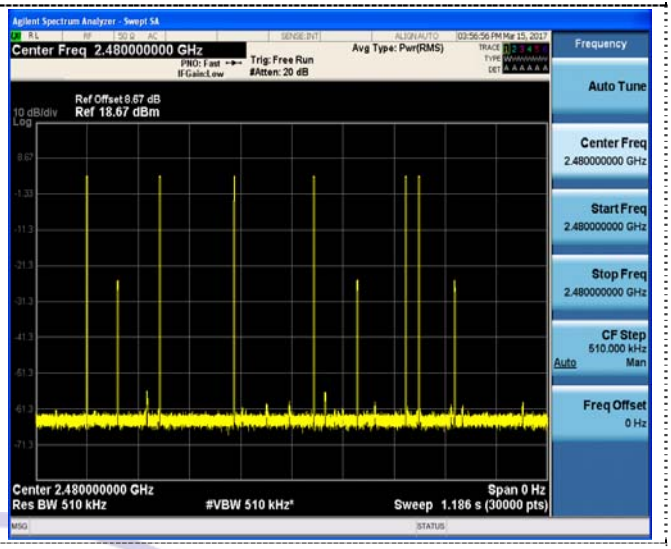
CH78

Frequency Occupation

GFSK

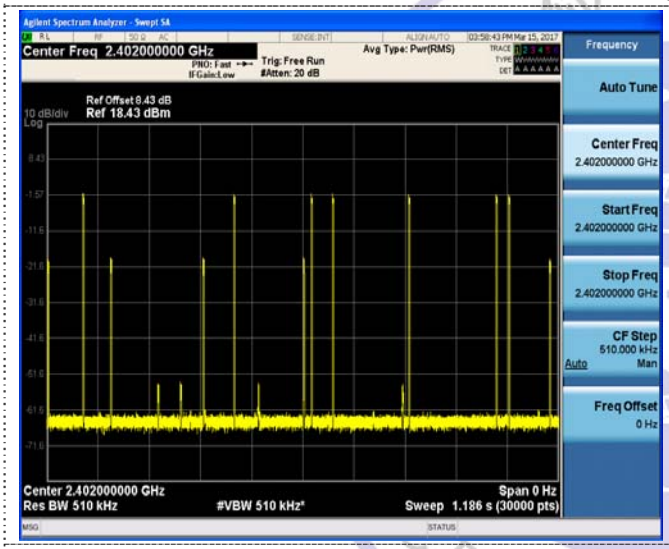


CH00

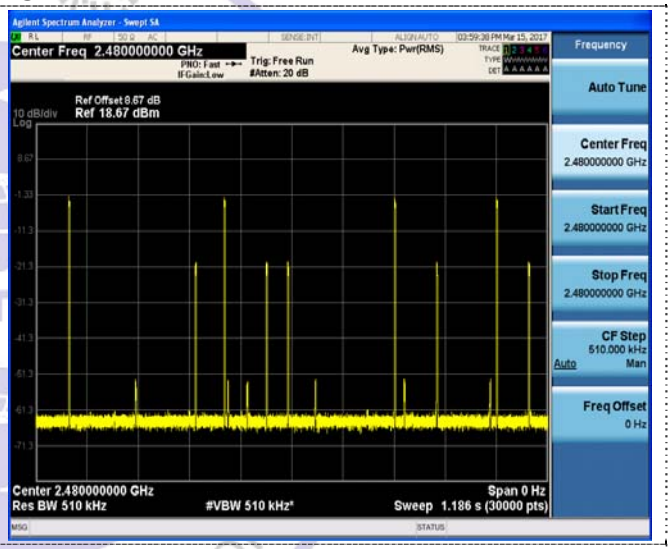


CH78

π/4QPSK

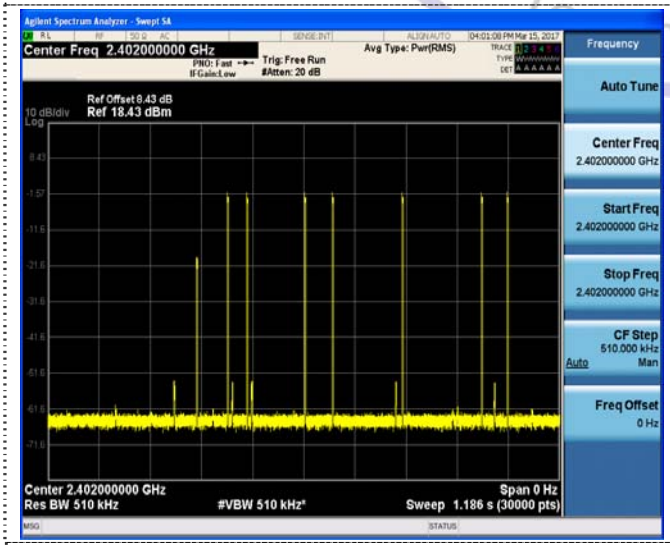


CH00

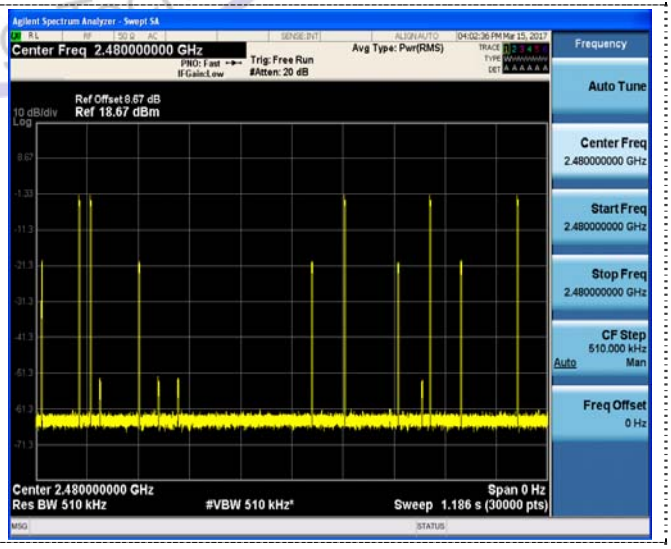


CH78

8DPSK



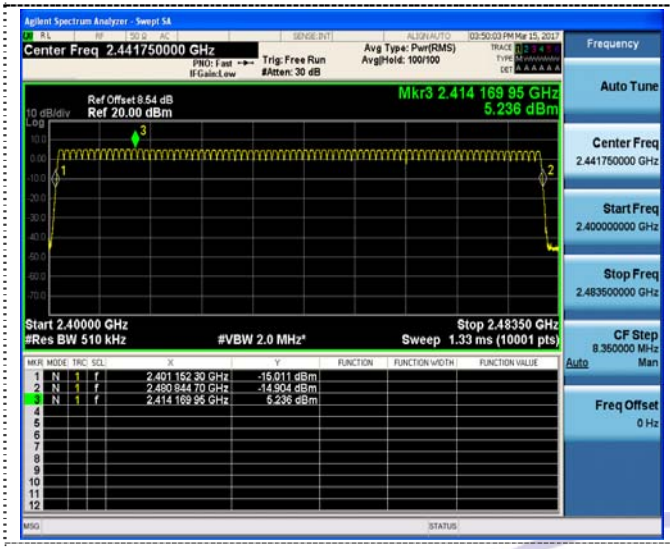
CH00



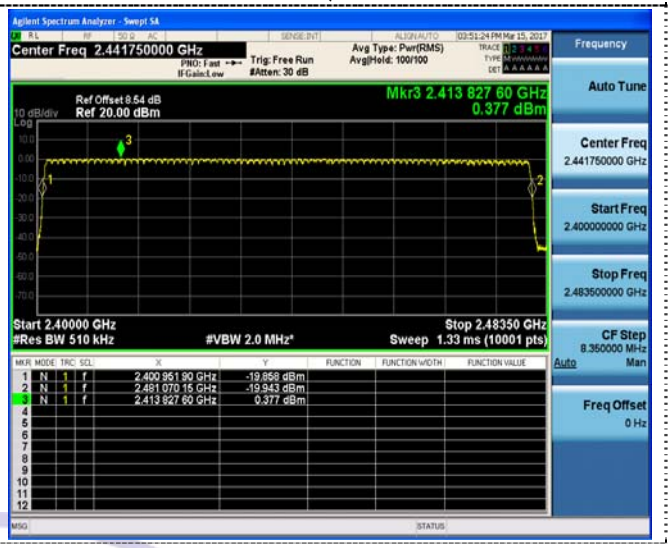
CH78

Hopping Sequence

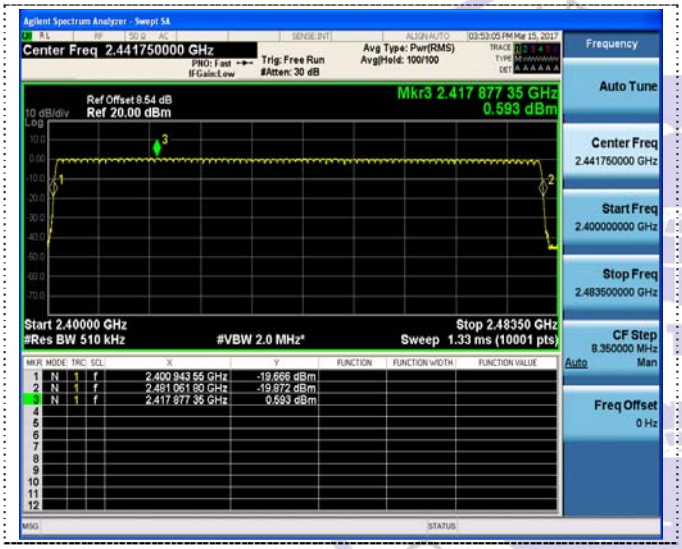
GFSK



π/4QPSK



8DPSK



3.5 Hopping Frequency Separation

Limit

ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.1.5.3

1. For non-adaptive Frequency Hopping equipment, the Hopping Frequency Separation shall be equal or greater than the Occupied Channel Bandwidth, with a minimum separation of 100 kHz. For equipment with a maximum declared RF Output power level of less than 10 dBm e.i.r.p. or for non-adaptive Frequency Hopping equipment operating in a mode where the RF Output power is less than 10 dBm e.i.r.p. only the minimum Hopping Frequency Separation of 100 kHz applies.
2. For adaptive Frequency Hopping equipment, the minimum Hopping Frequency Separation shall be 100 kHz.

Test Procedure

- **Step 1:** The output of the transmitter shall be connected to a spectrum analyser
- **Step 2:** The analyser shall be set as follows:

Centre Frequency:	Centre of the two adjacent hopping frequencies
Span:	Sufficient to see the complete power envelope of both hopping frequencies
Stop Frequency:	2 483,5 MHz
RBW:	1 % of the span
VBW:	3 × RBW
Detector Mode:	RMS
Sweep time:	1 s
Trace mode:	Max Hold

- **Step 3:** Wait for the trace to stabilize. Use the marker-delta function to determine the Hopping Frequency Separation between the centres of the two adjacent hopping frequencies (e.g. by indentifying peaks or notches at the centre of the power envelope for the two adjacent signals).

Test Results

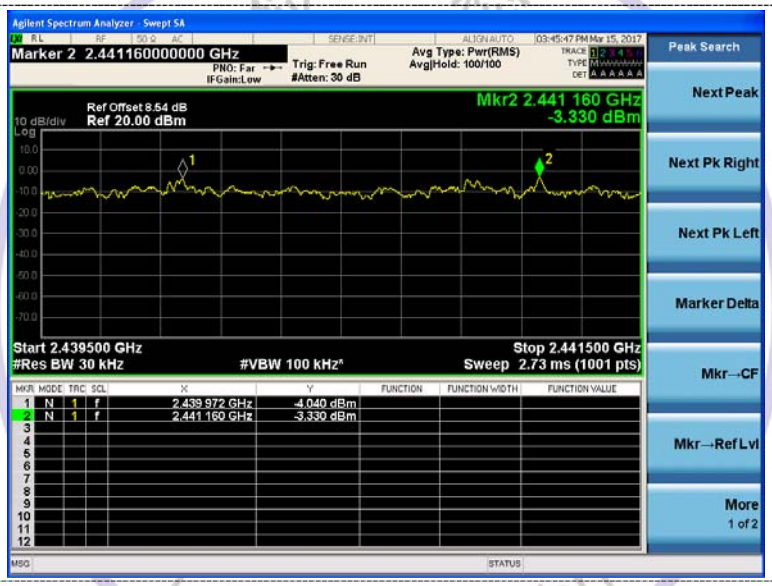
Modulation	Channel	Channel Separation (MHz)	Limit(kHz)	Result
GFSK	CH39	1.072	≥100	Pass
	CH40			
π/4QPSK	CH39	1.188	≥100	Pass
	CH40			
8DPSK	CH39	1.234	≥100	Pass
	CH40			

Note:
We have tested all mode at high, middle and low channel, and recorded worst case at middle

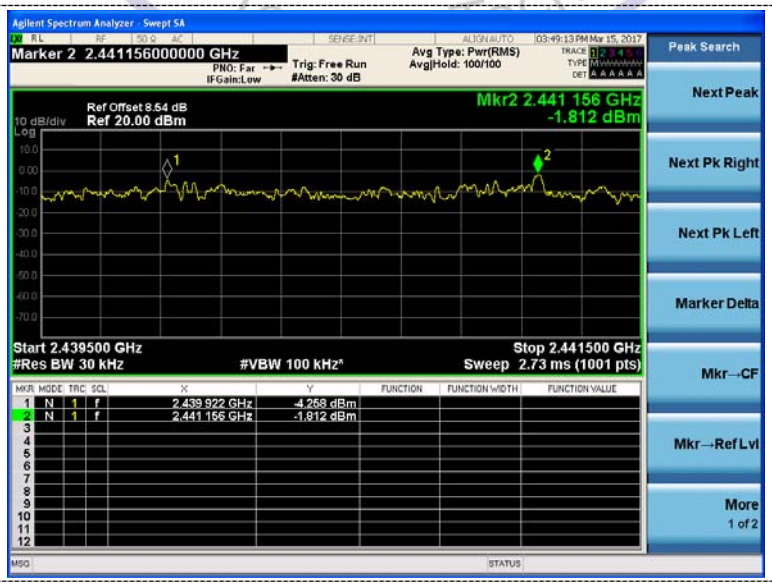
Test plot as follows:

GFSK

π/4QPSK



8DPSK



3.6 Medium Utilisation (MU) factor

Limit

ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.1.6.3&4.3.2.5.3

The maximum Medium Utilisation factor for non-adaptive equipment shall be 10 %.

Definition

The Medium Utilisation (MU) factor is a measure to quantify the amount of resources (Power and Time) used by non-adaptive equipment. The Medium Utilisation factor is defined by the formula:

MU = (P/100 mW) × DC

Where: MU is Medium Utilisation factor in %.

P is the RF output power expressed in mW.

DC is the Duty Cycle expressed in %.

NOTE: The equipment may have dynamic behaviour with regard to duty cycle and corresponding power level.

Test Results

Not applicable to this device which cannot operation in a non-adaptive mode.

3.7 Occupied Channel Bandwidth

Limit

ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.1.8.3&4.3.2.7.3

The Occupied Channel Bandwidth for each hopping frequency shall fall completely within the band 2.4GHz-2.4835GHz.

Test Procedure

1. The measurement shall be performed only on the lowest and the highest frequency within stated frequency range
2. The test procedure shall be follows:

Step1: Connect the UUT to the spectrum analyzer and use the following settings

Centre Frequency:	The centre frequency of the channel under test
Resolution BW:	~ 1% of the span without going below 1 %
Video BW:	3 × RBW
Frequency Span:	2 × Occupied Channel Bandwidth (e.g. 40 MHz for a 20 MHz channel)
Detector Mode:	RMS
Trace Mode:	MaxHold

Step 2: Wait until the trace is completed. Find the peak value of the trace and place the analyzer marker on this peak.

Step 3: Use the 99 % bandwidth function of the spectrum analyzer to measure the Occupied Channel Bandwidth of the EUT.

Test Result

WIFI

Mode	Channel	Occupied Channel Bandwidth (MHz)	f_L (MHz)	f_H (MHz)	Limit	Result
802.11b	CH01	11.346	2406.320	2477.635	$f_L \geqq 2.4GHz$ and $f_H \leqq$ 2.4835GHz	Pass
	CH13	11.373				
802.11g	CH01	16.602	2403.675	2480.263		
	CH13	16.620				
802.11n(HT20)	CH01	17.774	2403.094	2480.854		
	CH13	17.784				

BT3.0

Mode	Channel	Occupied Channel Bandwidth (MHz)	f_L (MHz)	f_H (MHz)	Limit	Result
GFSK	CH00	0.90912	2401.540	2480.458	$f_L \geqq 2.4GHz$ and $f_H \leqq$ 2.4835GHz	Pass
	CH78	0.90942				
π/4QPSK	CH00	1.2261	2401.385	2480.621		
	CH78	1.2275				
8DPSK	CH00	1.2332	2401.374	2480.616		
	CH78	1.2336				

BT4.0

Mode	Channel	Occupied Channel Bandwidth (MHz)	f_L (MHz)	f_H (MHz)	Limit	Result
GFSK	CH00	1.0668	2401.471	2480.547	$f_L \geqq 2.4GHz$ and $f_H \leqq$ 2.4835GHz	Pass
	CH39	1.0679				

WIFI

802.11b

CH01

CH13

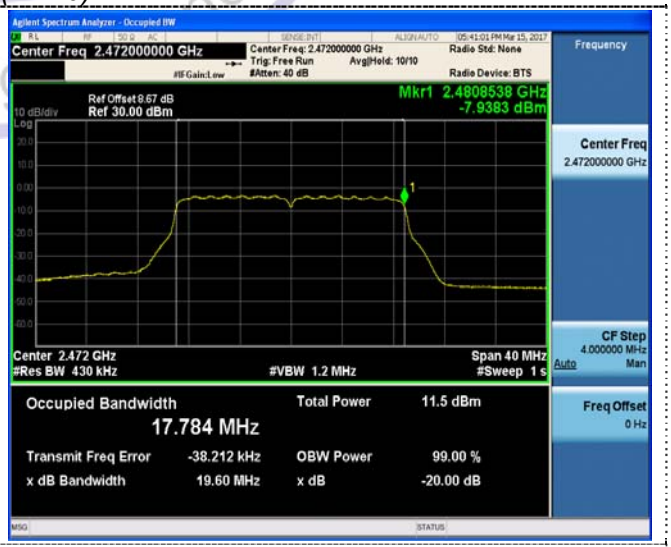
802.11g

CH01

CH13

802.11n(HT20)

CH01



CH13

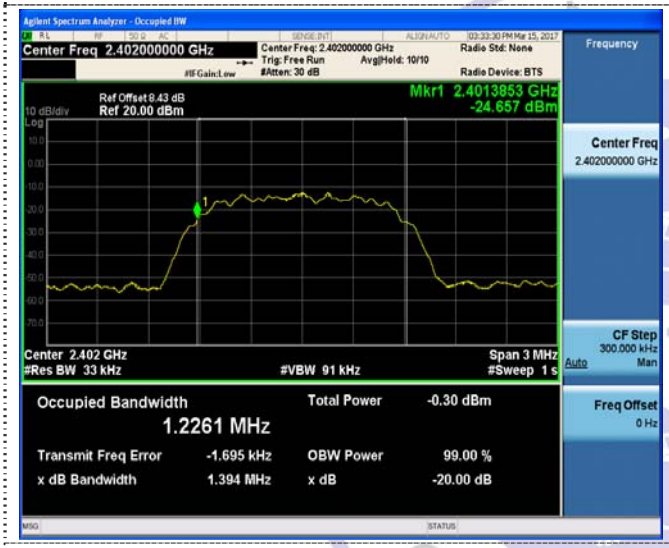
BT3.0

GFSK

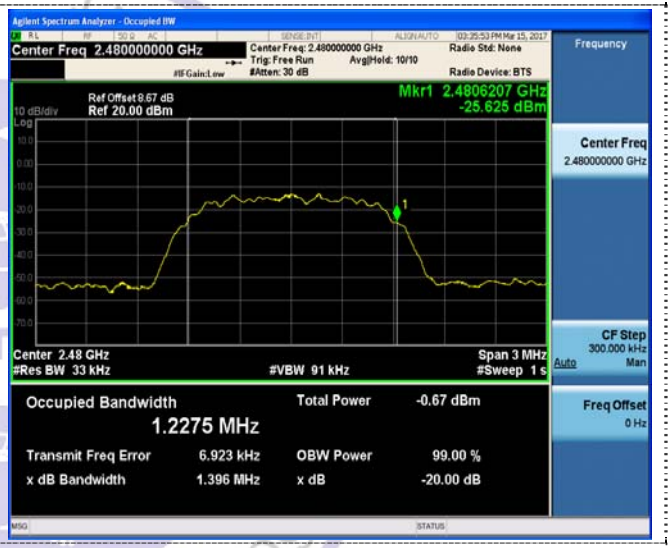
CH00

CH78

π/4QPSK



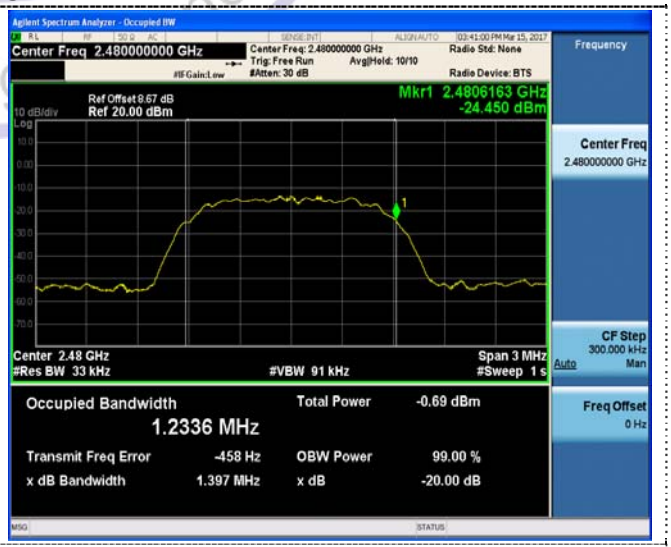
CH00



CH78

8DPSK

CH00



CH78

BT4.0

GFSK

CH00

CH39

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

Limit

ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.1.9.3&4.3.2.8.3

The transmitter unwanted emissions in the out-of-band domain but outside the allocated band, shall not exceed the values provided by the mask in figure 1.

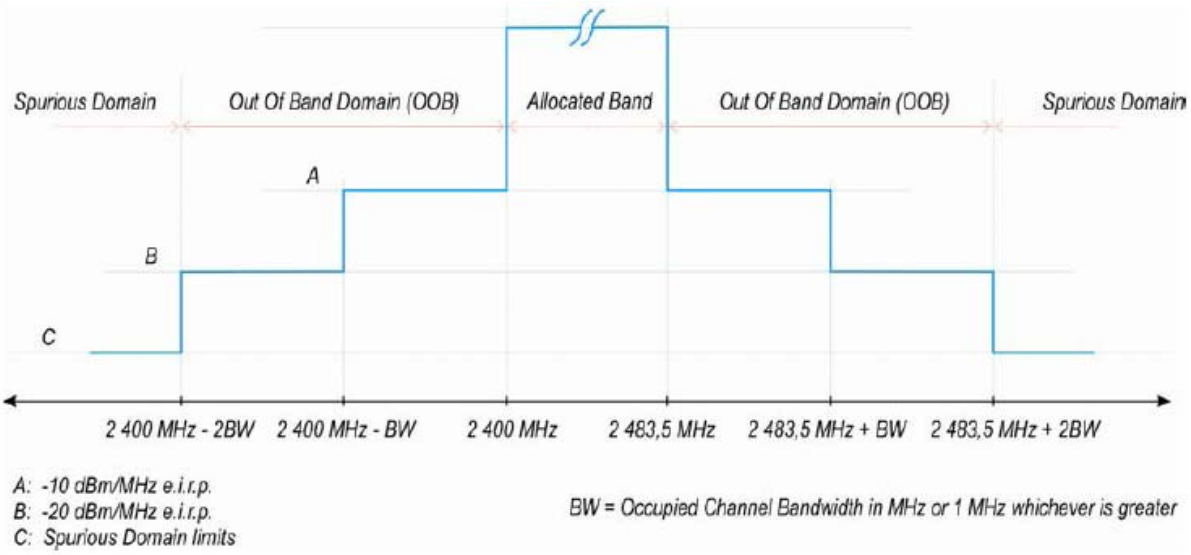


Figure 1: Transmit mask

Test Procedure

1. The measurements shall be performed at both normal environmental conditions and at the extremes of the operating temperature range.
2. For conducted measurements on devices with multiple transmit chains using the results for each of the transmit chains for the corresponding 1MHz segments shall be added and compared with the transmit mask limit.
3. The analyzer shall be set as follows:

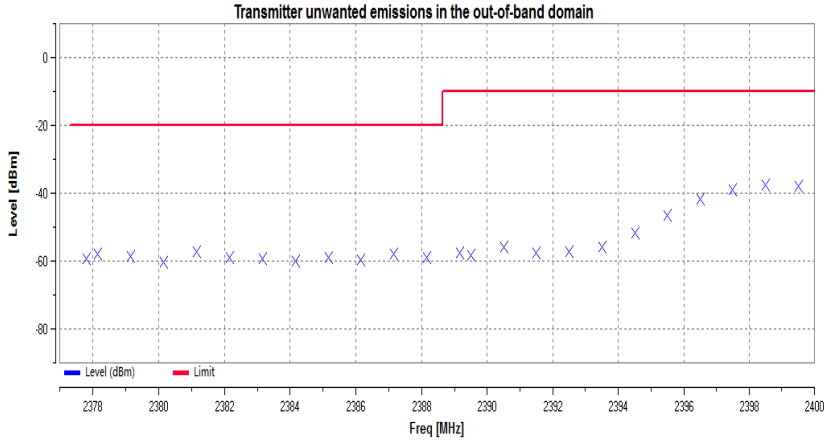
Centre Frequency:	Center of each segments
Frequency Span:	0 Hz
RBW:	1M
VBW:	3M
Filter mode:	Channel filter
Trace Mode:	Clear / Write
Detector Mode:	RMS
Number of sweep points:	5 000
Sweep mode:	Continuous
Trigger:	Video trigger
Sweep Time:	> 120 % of the duration of the longest burst detected

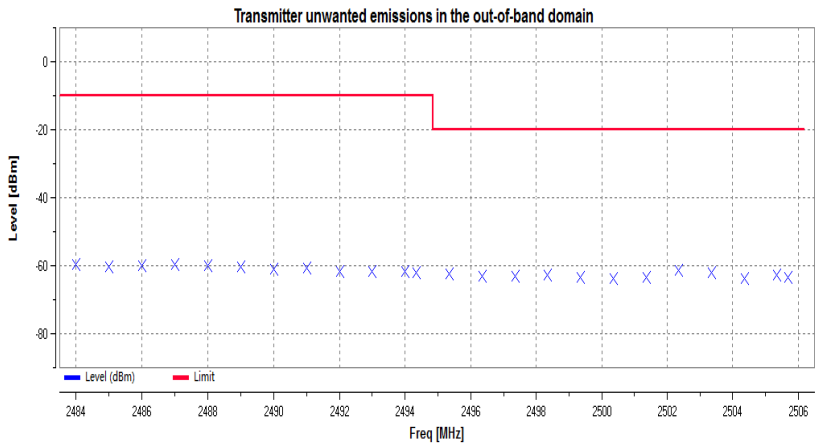
4. Save the value measured of each segments.

Test Result

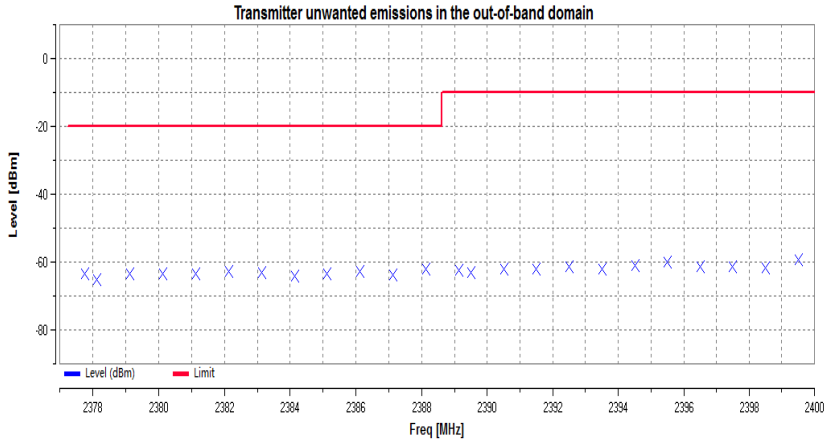
Remark: The datum recorded below represents the worst emission level in each segment and the plot for normal condition.

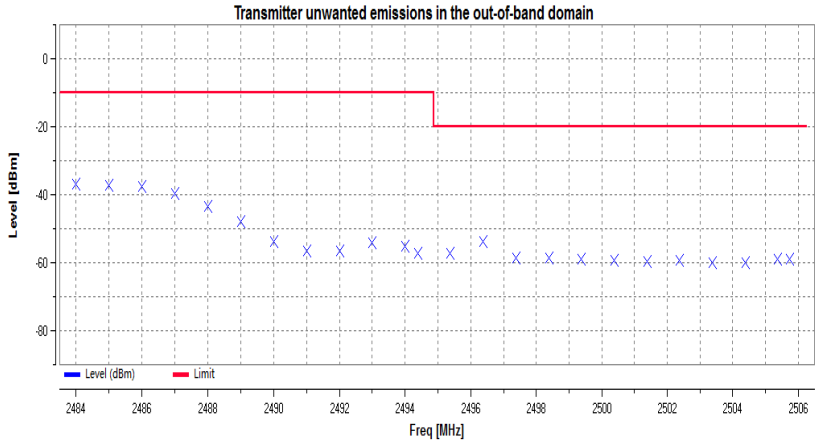
802.11b CH01								
Test Condition			OOB Frequency (MHz)	Measured Level (dBm)	Antenna Gain (dBi)	Results (dBm)	Limit (dBm)	Result
BW (MHz)	Voltage (V)	Temperature (℃)						
11.346	230	25	2381.154	-57.11	0.00	-57.11	-20	PASS
			2398.500	-37.72	0.00	-37.72	-10	PASS
			2484.000	-59.60	0.00	-59.60	-10	PASS
			2502.346	-61.53	0.00	-61.53	-20	PASS
		-20	2381.154	-56.45	0.00	-56.45	-20	PASS
			2398.500	-37.87	0.00	-37.87	-10	PASS
			2484.000	-59.41	0.00	-59.41	-10	PASS
			2502.346	-61.69	0.00	-61.69	-20	PASS
		55	2381.154	-57.22	0.00	-57.22	-20	PASS
			2398.500	-37.87	0.00	-37.87	-10	PASS
			2484.000	-58.56	0.00	-58.56	-10	PASS
			2502.346	-61.41	0.00	-61.41	-20	PASS



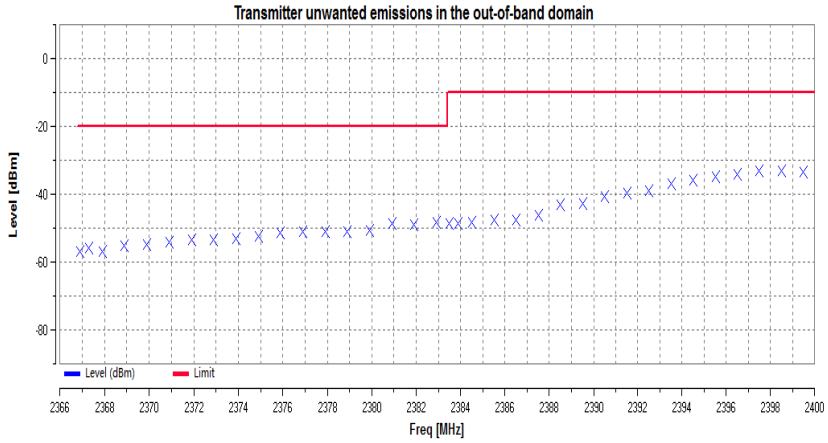


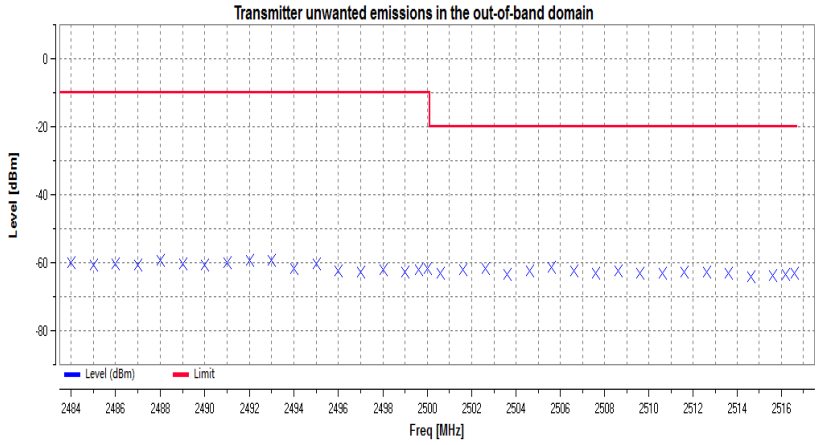
802.11b CH13								
Test Condition			OOB Frequency (MHz)	Measured Level (dBm)	Antenna Gain (dBi)	Results (dBm)	Limit (dBm)	Result
BW (MHz)	Voltage (V)	Temperature (℃)						
11.373	230	25	2388.127	-62.06	0.00	-62.06	-20	PASS
			2399.500	-59.25	0.00	-59.25	-10	PASS
			2484.000	-36.91	0.00	-36.91	-10	PASS
			2496.373	-53.90	0.00	-53.90	-20	PASS
		-20	2388.127	-62.19	0.00	-62.19	-20	PASS
			2399.500	-59.34	0.00	-59.34	-10	PASS
			2484.000	-36.74	0.00	-36.74	-10	PASS
			2496.373	-53.88	0.00	-53.88	-20	PASS
		55	2388.127	-62.16	0.00	-62.16	-20	PASS
			2399.500	-59.39	0.00	-59.39	-10	PASS
			2484.000	-36.45	0.00	-36.45	-10	PASS
			2496.373	-53.71	0.00	-53.71	-20	PASS



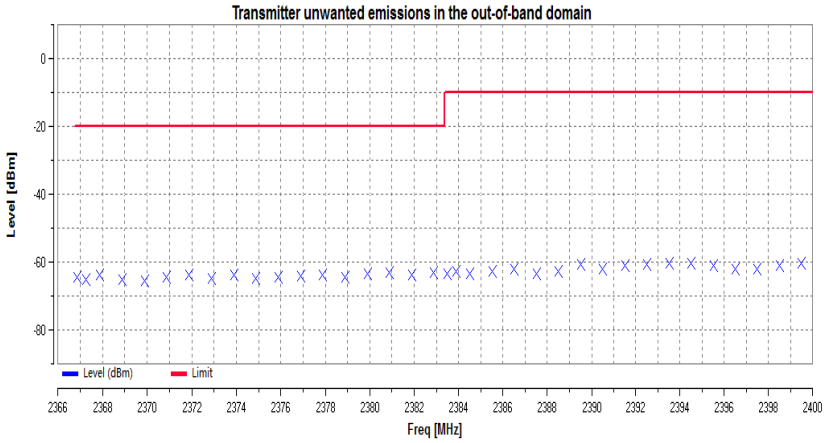


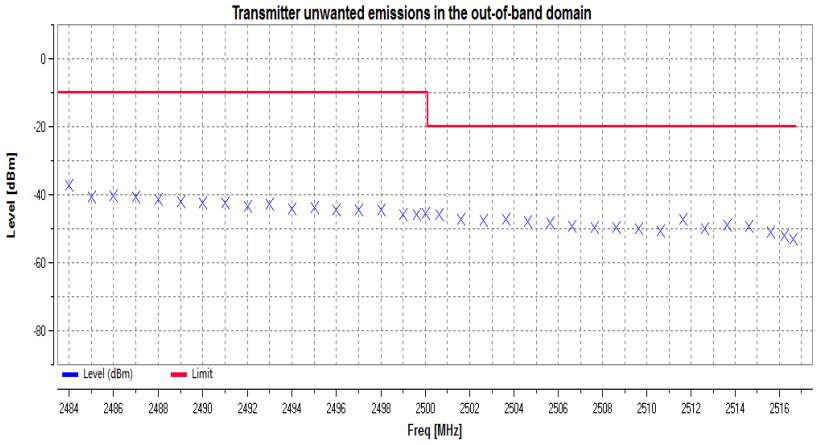
802.11g CH01								
Test Condition			OOB Frequency (MHz)	Measured Level (dBm)	Antenna Gain (dBi)	Results (dBm)	Limit (dBm)	Result
BW (MHz)	Voltage (V)	Temperature (℃)						
16.602	230	25	2382.898	-48.32	0.00	-48.32	-20	PASS
			2398.500	-33.03	0.00	-33.03	-10	PASS
			2488.000	-59.22	0.00	-59.22	-10	PASS
			2505.602	-61.53	0.00	-61.53	-20	PASS
		-20	2382.898	-48.54	0.00	-48.54	-20	PASS
			2398.500	-33.21	0.00	-33.21	-10	PASS
			2488.000	-59.69	0.00	-59.69	-10	PASS
			2505.602	-60.87	0.00	-60.87	-20	PASS
		55	2382.898	-48.45	0.00	-48.45	-20	PASS
			2398.500	-33.11	0.00	-33.11	-10	PASS
			2488.000	-59.56	0.00	-59.56	-10	PASS
			2505.602	-61.41	0.00	-61.41	-20	PASS



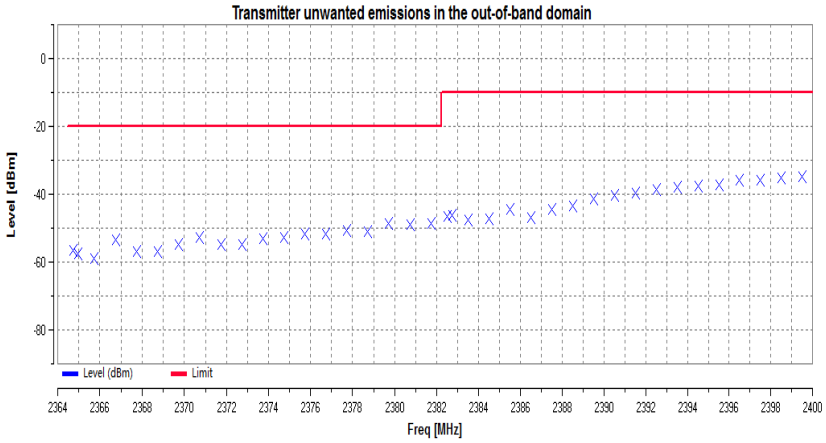


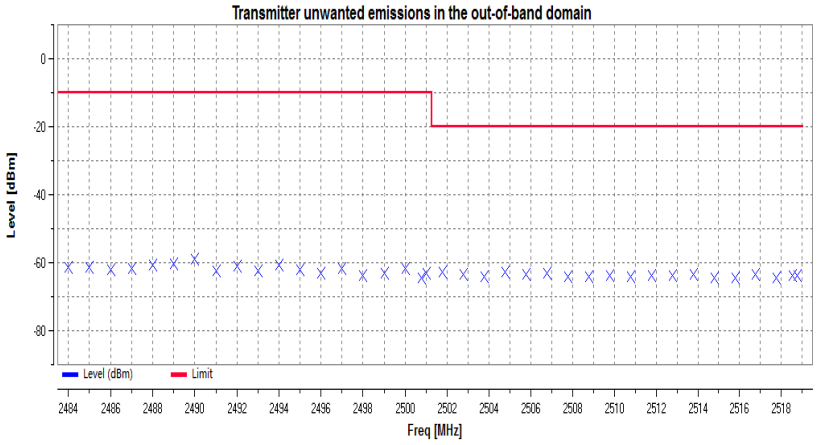
802.11g CH13								
Test Condition			OOB Frequency (MHz)	Measured Level (dBm)	Antenna Gain (dBi)	Results (dBm)	Limit (dBm)	Result
BW (MHz)	Voltage (V)	Temperature (℃)						
16.620	230	25	2382.880	-63.10	0.00	-63.10	-20	PASS
			2394.500	-60.20	0.00	-60.20	-10	PASS
			2484.000	-37.27	0.00	-37.27	-10	PASS
			2500.620	-46.02	0.00	-46.02	-20	PASS
		-20	2382.880	-63.26	0.00	-63.26	-20	PASS
			2394.500	-60.79	0.00	-60.79	-10	PASS
			2484.000	-37.55	0.00	-37.55	-10	PASS
			2500.620	-46.41	0.00	-46.41	-20	PASS
		55	2382.880	-64.29	0.00	-64.29	-20	PASS
			2394.500	-60.74	0.00	-60.74	-10	PASS
			2484.000	-37.66	0.00	-37.66	-10	PASS
			2500.620	-45.21	0.00	-45.21	-20	PASS



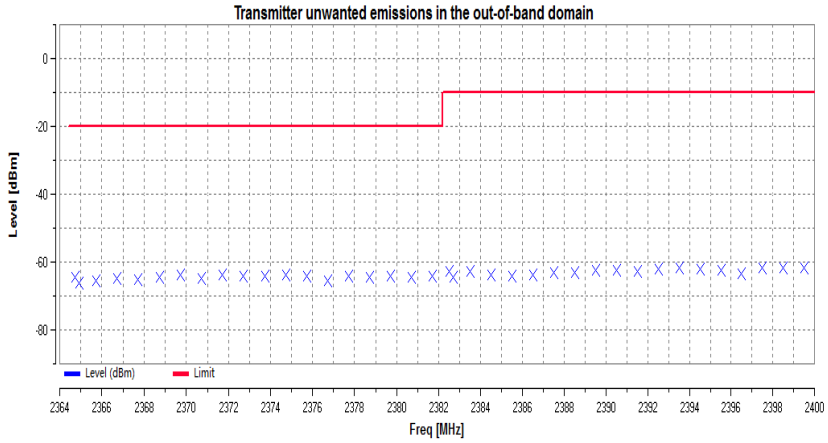


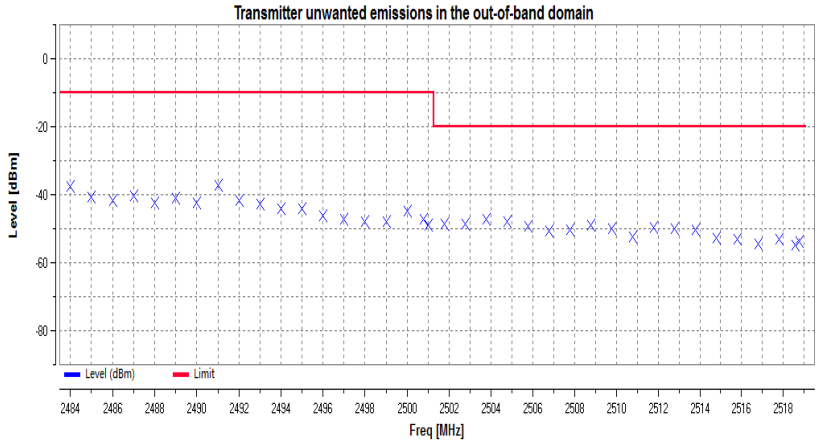
802.11n20 CH01								
Test Condition			OOB Frequency (MHz)	Measured Level (dBm)	Antenna Gain (dBi)	Results (dBm)	Limit (dBm)	Result
BW (MHz)	Voltage (V)	Temperature (℃)						
17.774	230	25	2379.726	-48.45	0.00	-48.45	-20	PASS
			2399.500	-34.71	0.00	-34.71	-10	PASS
			2490.000	-58.91	0.00	-58.91	-10	PASS
			2504.774	-62.67	0.00	-62.67	-20	PASS
		-20	2379.726	-47.65	0.00	-47.65	-20	PASS
			2399.500	-34.87	0.00	-34.87	-10	PASS
			2490.000	-58.89	0.00	-58.89	-10	PASS
			2504.774	-62.55	0.00	-62.55	-20	PASS
		55	2379.726	-48.32	0.00	-48.32	-20	PASS
			2399.500	-34.64	0.00	-34.64	-10	PASS
			2490.000	-58.77	0.00	-58.77	-10	PASS
			2504.774	-62.54	0.00	-62.54	-20	PASS





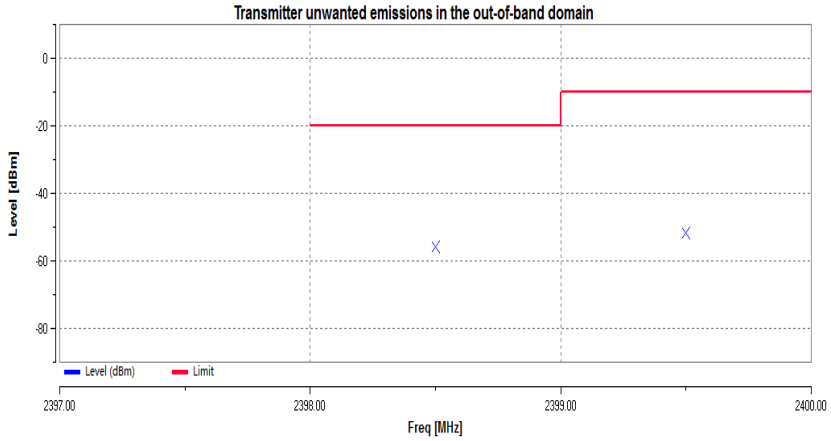
802.11n20 CH13								
Test Condition			OOB Frequency (MHz)	Measured Level (dBm)	Antenna Gain (dBi)	Results (dBm)	Limit (dBm)	Result
BW (MHz)	Voltage (V)	Temperature (℃)						
17.784	230	25	2371.716	-63.71	0.00	-63.71	-20	PASS
			2399.500	-61.63	0.00	-61.63	-10	PASS
			2491.000	-37.25	0.00	-37.25	-10	PASS
			2503.784	-47.29	0.00	-47.29	-20	PASS
		-20	2371.716	-64.25	0.00	-64.25	-20	PASS
			2399.500	-61.66	0.00	-61.66	-10	PASS
			2491.000	-37.78	0.00	-37.78	-10	PASS
			2503.784	-47.69	0.00	-47.69	-20	PASS
		55	2371.716	-64.25	0.00	-64.25	-20	PASS
			2399.500	-61.54	0.00	-61.54	-10	PASS
			2491.000	-37.48	0.00	-37.48	-10	PASS
			2503.784	-47.39	0.00	-47.39	-20	PASS

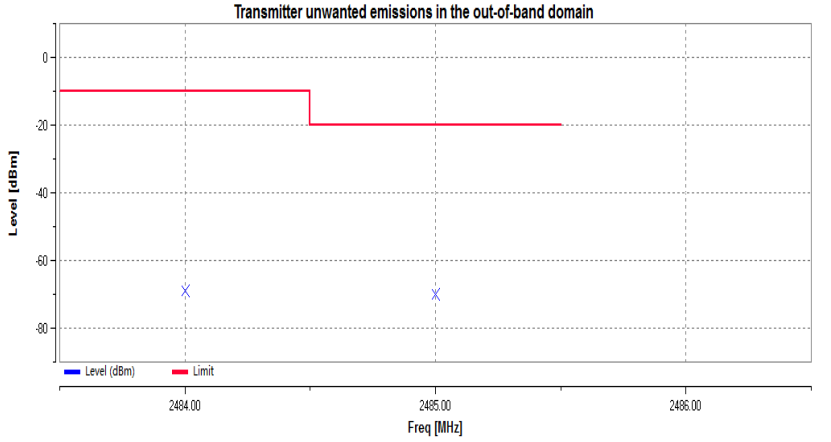




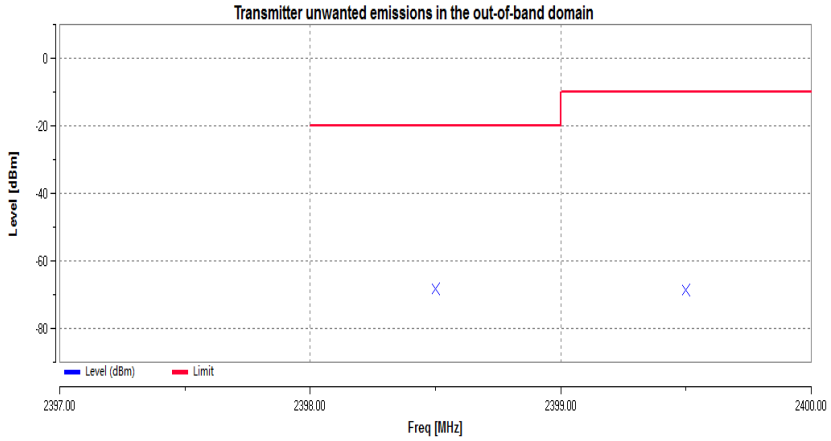
BT3.0

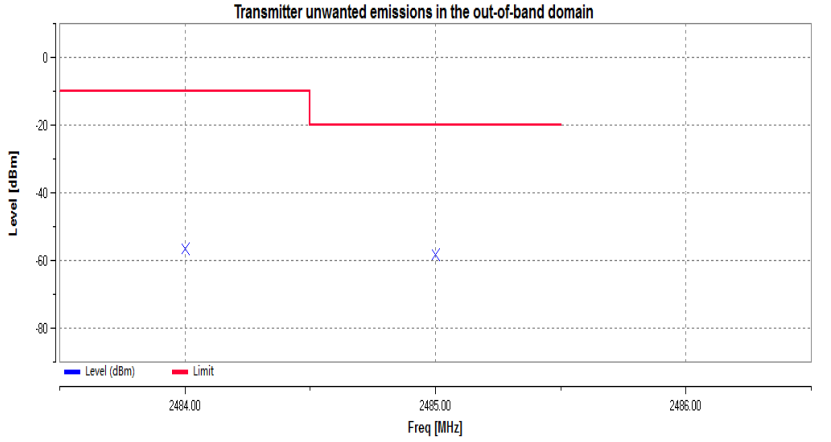
GFSK CH00								
Test Condition			OOB Frequency (MHz)	Measured Level (dBm)	Antenna Gain (dBi)	Results (dBm)	Limit (dBm)	Result
BW (MHz)	Voltage (V)	Temperature (℃)						
1.000	230	25	2398.500	-55.79	0.00	-55.79	-20	PASS
			2399.500	-51.64	0.00	-51.64	-10	PASS
			2484.000	-68.98	0.00	-68.98	-10	PASS
			2485.000	-69.96	0.00	-69.96	-20	PASS
		-20	2398.500	-55.69	0.00	-55.69	-20	PASS
			2399.500	-51.52	0.00	-51.52	-10	PASS
			2484.000	-68.45	0.00	-68.45	-10	PASS
			2485.000	-69.87	0.00	-69.87	-20	PASS
		55	2398.500	-55.66	0.00	-55.66	-20	PASS
			2399.500	-51.21	0.00	-51.21	-10	PASS
			2484.000	-69.57	0.00	-69.57	-10	PASS
			2485.000	-69.71	0.00	-69.71	-20	PASS



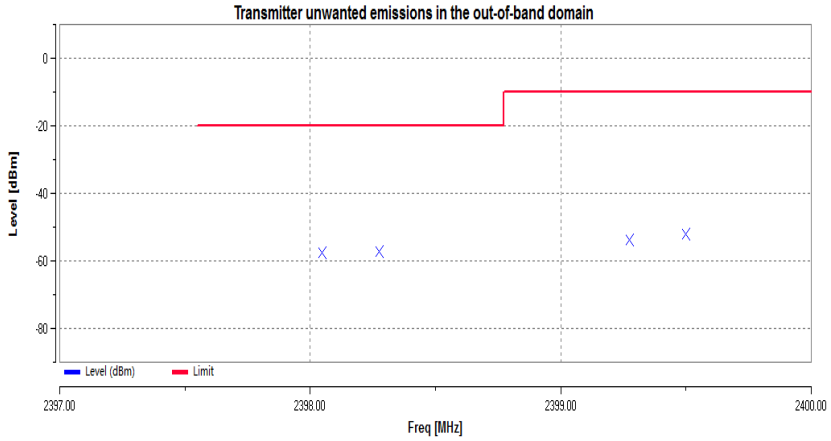


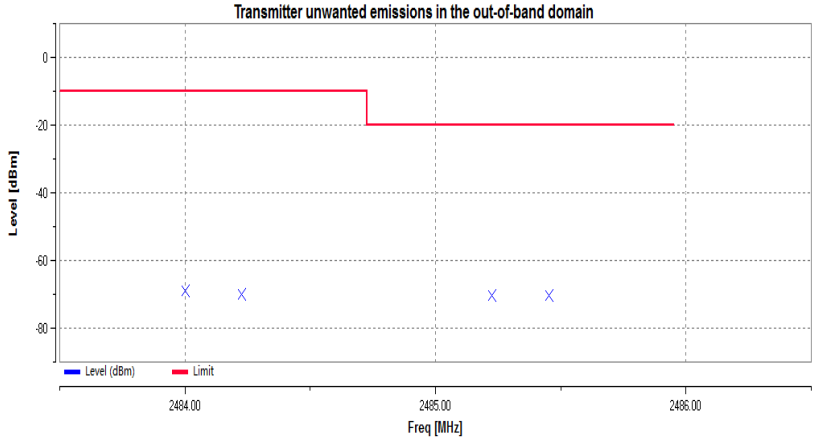
GFSK CH78								
Test Condition			OOB Frequency (MHz)	Measured Level (dBm)	Antenna Gain (dBi)	Results (dBm)	Limit (dBm)	Result
BW (MHz)	Voltage (V)	Temperature (℃)						
1.000	230	25	2398.500	-68.26	0.00	-68.26	-20	PASS
			2399.500	-68.56	0.00	-68.56	-10	PASS
			2484.000	-56.61	0.00	-56.61	-10	PASS
			2485.000	-58.19	0.00	-58.19	-20	PASS
		-20	2398.500	-68.56	0.00	-68.56	-20	PASS
			2399.500	-68.47	0.00	-68.47	-10	PASS
			2484.000	-56.58	0.00	-56.58	-10	PASS
			2485.000	-57.56	0.00	-57.56	-20	PASS
		55	2398.500	-68.34	0.00	-68.34	-20	PASS
			2399.500	-68.55	0.00	-68.55	-10	PASS
			2484.000	-56.98	0.00	-56.98	-10	PASS
			2485.000	-58.74	0.00	-58.74	-20	PASS



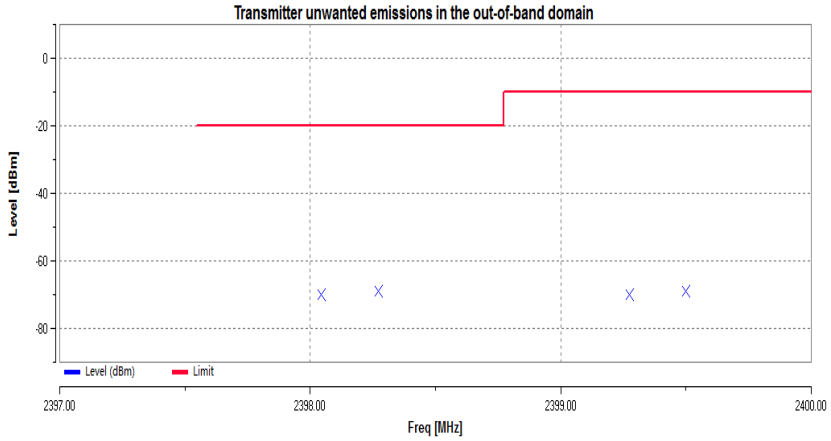


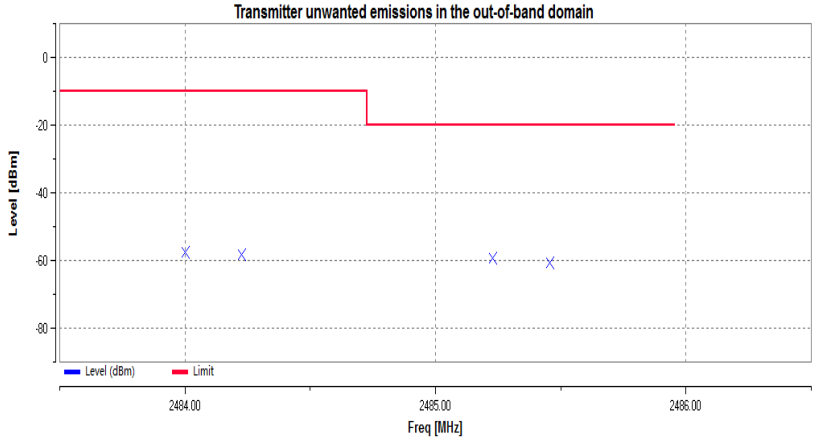
π/4QPSK CH00								
Test Condition			OOB Frequency (MHz)	Measured Level (dBm)	Antenna Gain (dBi)	Results (dBm)	Limit (dBm)	Result
BW (MHz)	Voltage (V)	Temperature (℃)						
1.2261	230	25	2398.274	-57.37	0.00	-57.37	-20	PASS
			2399.500	-52.09	0.00	-52.09	-10	PASS
			2484.000	-68.99	0.00	-68.99	-10	PASS
			2485.226	-70.23	0.00	-70.23	-20	PASS
		-20	2398.274	-57.15	0.00	-57.15	-20	PASS
			2399.500	-53.52	0.00	-53.52	-10	PASS
			2484.000	-68.44	0.00	-68.44	-10	PASS
			2485.226	-70.45	0.00	-70.45	-20	PASS
		55	2398.274	-57.78	0.00	-57.78	-20	PASS
			2399.500	-52.51	0.00	-52.51	-10	PASS
			2484.000	-68.15	0.00	-68.15	-10	PASS
			2485.226	-70.36	0.00	-70.36	-20	PASS



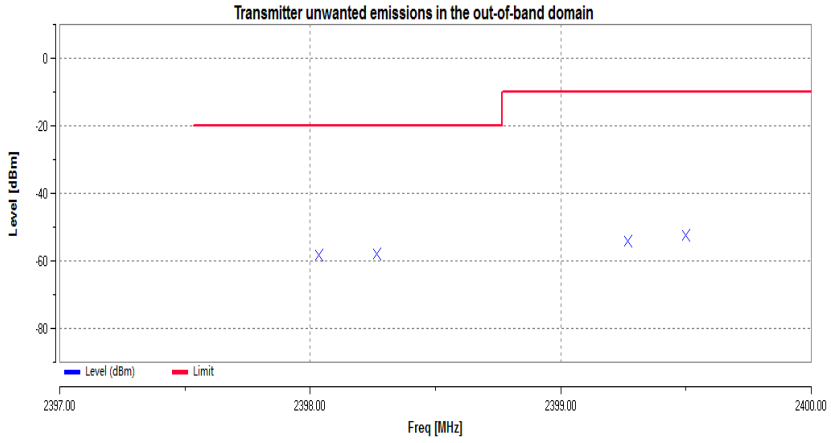


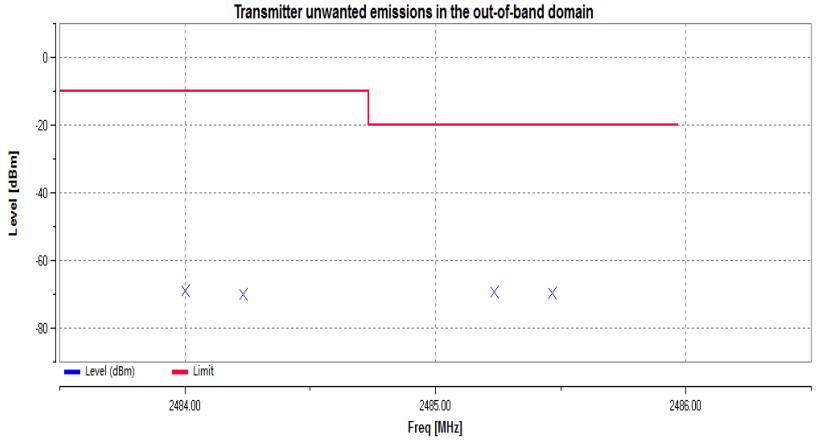
π/4QPSK CH78								
Test Condition			OOB Frequency (MHz)	Measured Level (dBm)	Antenna Gain (dBi)	Results (dBm)	Limit (dBm)	Result
BW (MHz)	Voltage (V)	Temperature (℃)						
1.2275	230	25	2398.273	-68.82	0.00	-68.82	-20	PASS
			2399.500	-69.13	0.00	-69.13	-10	PASS
			2484.000	-57.43	0.00	-57.43	-10	PASS
			2485.228	-59.24	0.00	-59.24	-20	PASS
		-20	2398.273	-68.75	0.00	-68.75	-20	PASS
			2399.500	-69.62	0.00	-69.62	-10	PASS
			2484.000	-57.51	0.00	-57.51	-10	PASS
			2485.228	-58.96	0.00	-58.96	-20	PASS
		55	2398.273	-68.75	0.00	-68.75	-20	PASS
			2399.500	-69.22	0.00	-69.22	-10	PASS
			2484.000	-57.87	0.00	-57.87	-10	PASS
			2485.228	-58.56	0.00	-58.56	-20	PASS



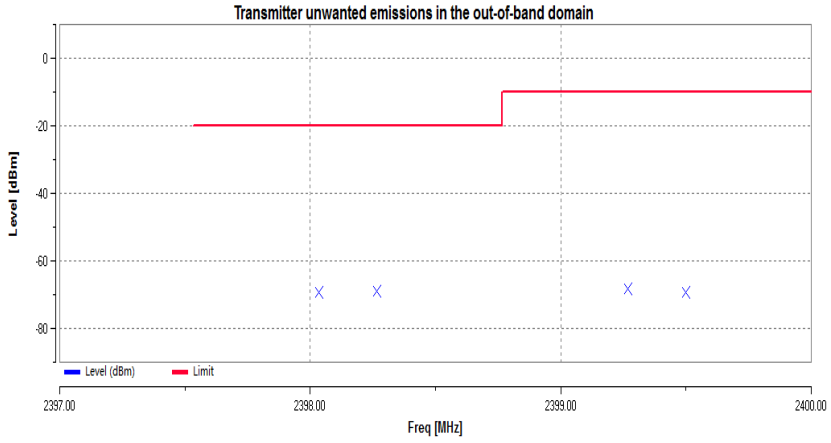


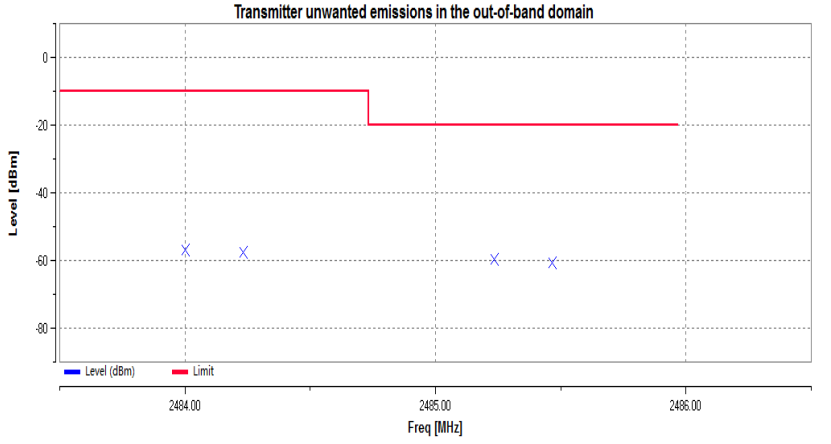
8DPSK CH00								
Test Condition			OOB Frequency (MHz)	Measured Level (dBm)	Antenna Gain (dBi)	Results (dBm)	Limit (dBm)	Result
BW (MHz)	Voltage (V)	Temperature (℃)						
1.2332	230	25	2398.267	-57.86	0.00	-57.86	-20	PASS
			2399.500	-52.36	0.00	-52.36	-10	PASS
			2484.000	-68.87	0.00	-68.87	-10	PASS
			2485.233	-69.39	0.00	-69.39	-20	PASS
		-20	2398.267	-56.52	0.00	-56.52	-20	PASS
			2399.500	-52.44	0.00	-52.44	-10	PASS
			2484.000	-68.74	0.00	-68.74	-10	PASS
			2485.233	-69.51	0.00	-69.51	-20	PASS
		55	2398.267	-56.29	0.00	-56.29	-20	PASS
			2399.500	-52.52	0.00	-52.52	-10	PASS
			2484.000	-68.47	0.00	-68.47	-10	PASS
			2485.233	-69.42	0.00	-69.42	-20	PASS





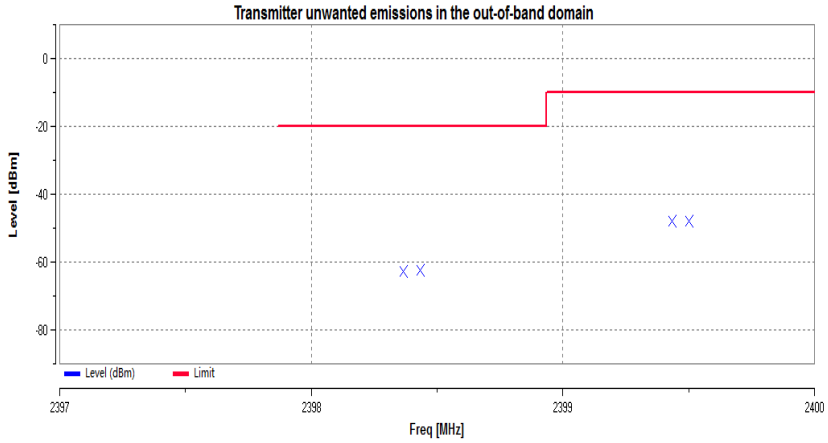
8DPSK CH78								
Test Condition			OOB Frequency (MHz)	Measured Level (dBm)	Antenna Gain (dBi)	Results (dBm)	Limit (dBm)	Result
BW (MHz)	Voltage (V)	Temperature (℃)						
1.2336	230	25	2398.266	-69.03	0.00	-69.03	-20	PASS
			2399.266	-68.27	0.00	-68.27	-10	PASS
			2484.000	-57.02	0.00	-57.02	-10	PASS
			2485.234	-59.76	0.00	-59.76	-20	PASS
		-20	2398.266	-68.75	0.00	-68.75	-20	PASS
			2399.266	-68.63	0.00	-68.63	-10	PASS
			2484.000	-57.41	0.00	-57.41	-10	PASS
			2485.234	-59.98	0.00	-59.98	-20	PASS
		55	2398.266	-69.54	0.00	-69.54	-20	PASS
			2399.266	-68.33	0.00	-68.33	-10	PASS
			2484.000	-57.64	0.00	-57.64	-10	PASS
			2485.234	-59.48	0.00	-59.48	-20	PASS

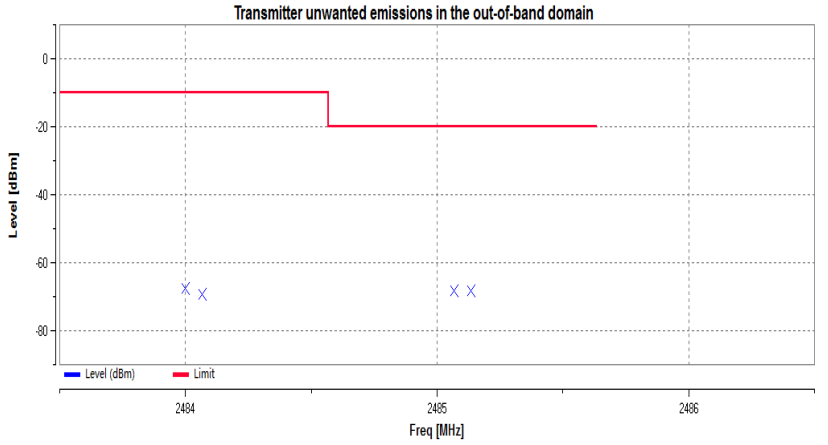




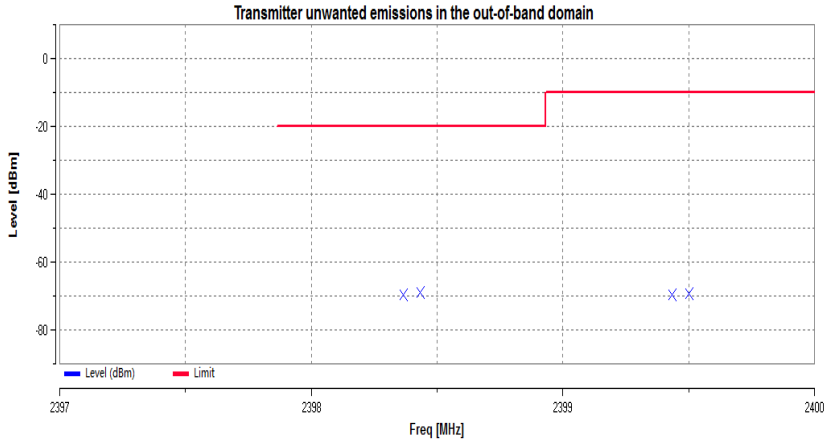
BT4.0

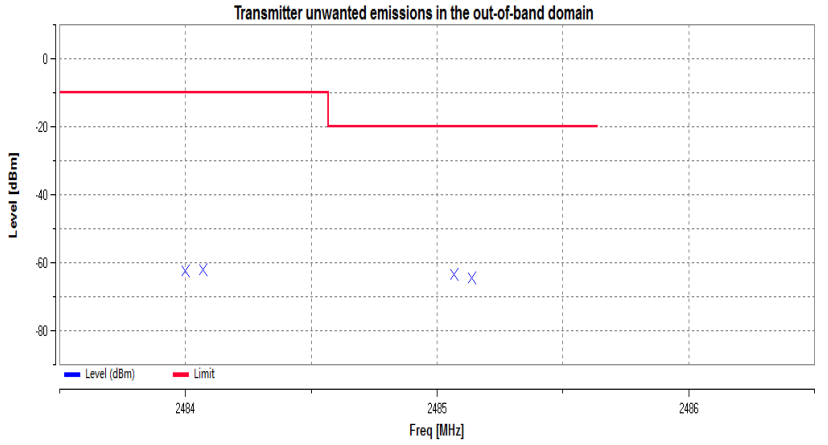
GFSK CH00								
Test Condition			OOB Frequency (MHz)	Measured Level (dBm)	Antenna Gain (dBi)	Results (dBm)	Limit (dBm)	Result
BW (MHz)	Voltage (V)	Temperature (℃)						
1.0668	230	25	2398.433	-62.36	0.00	-62.36	-20	PASS
			2399.433	-47.82	0.00	-47.82	-10	PASS
			2484.000	-67.68	0.00	-67.68	-10	PASS
			2485.134	-68.13	0.00	-68.13	-20	PASS
		-20	2398.433	-62.47	0.00	-62.47	-20	PASS
			2399.433	-47.79	0.00	-47.79	-10	PASS
			2484.000	-67.56	0.00	-67.56	-10	PASS
			2485.134	-68.22	0.00	-68.22	-20	PASS
		55	2398.433	-63.63	0.00	-63.63	-20	PASS
			2399.433	-47.74	0.00	-47.74	-10	PASS
			2484.000	-67.56	0.00	-67.56	-10	PASS
			2485.134	-68.29	0.00	-68.29	-20	PASS





GFSK CH39								
Test Condition			OOB Frequency (MHz)	Measured Level (dBm)	Antenna Gain (dBi)	Results (dBm)	Limit (dBm)	Result
BW (MHz)	Voltage (V)	Temperature (℃)						
1.0679	230	25	2398.432	-69.00	0.00	-69.00	-20	PASS
			2399.500	-69.36	0.00	-69.36	-10	PASS
			2484.068	-61.97	0.00	-61.97	-10	PASS
			2485.068	-63.43	0.00	-63.43	-20	PASS
		-20	2398.432	-68.75	0.00	-68.75	-20	PASS
			2399.500	-69.66	0.00	-69.66	-10	PASS
			2484.068	-61.54	0.00	-61.54	-10	PASS
			2485.068	-62.54	0.00	-62.54	-20	PASS
		55	2398.432	-69.25	0.00	-69.25	-20	PASS
			2399.500	-69.33	0.00	-69.33	-10	PASS
			2484.068	-61.87	0.00	-61.87	-10	PASS
			2485.068	-64.23	0.00	-64.23	-20	PASS





3.9 Transmitter unwanted emissions in the spurious domain

Limit

ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.1.10.3 & 4.3.2.9.3

The transmitter unwanted emissions in the spurious domain shall not exceed the values given in table

Table 1: Transmitter limits for spurious emissions

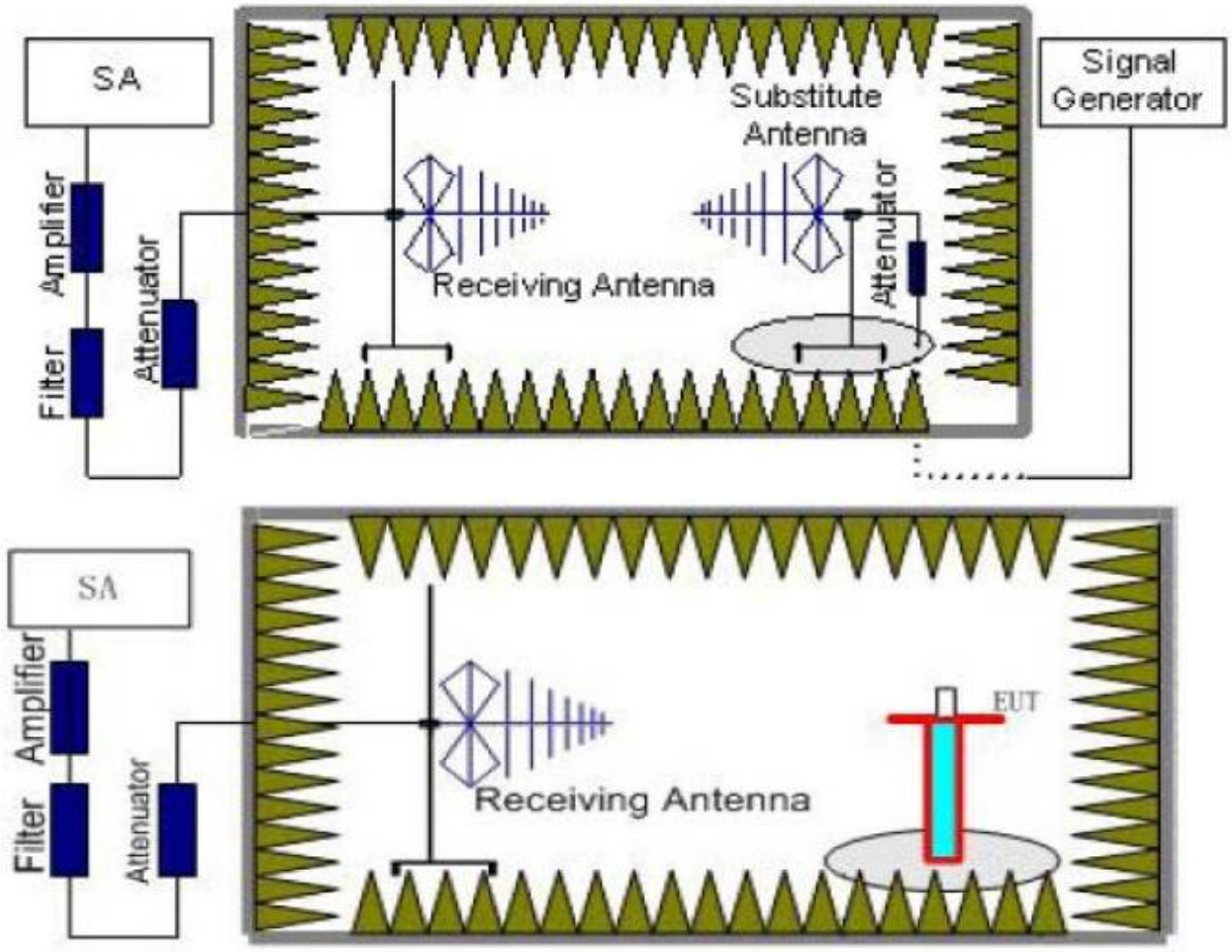
Frequency Range	Maximum power e.r.p.(≤1 GHz) e.i.r.p.(＞1 GHz)	Bandwidth
30 MHz to 47 MHz	-36 dBm	100 KHz
47 MHz to 74 MHz	-54 dBm	100 KHz
74MHz to 87.5 MHz	-36 dBm	100 KHz
87.5 MHz to 118 MHz	-54 dBm	100 KHz
118 MHz to 174 MHz	-36 dBm	100 KHz
174 MHz to 230 MHz	-54 dBm	100 KHz
230 MHz to 470 MHz	-36 dBm	100 KHz
470 MHz to 862 MHz	-54 dBm	100 KHz
862 MHz to 1 GHz	-36 dBm	100 KHz
1 GHz to 12.75 GHz	-30 dBm	1 MHz

Test Procedure

1. The measurement performed at the lowest and the highest channel on which the equipment can operate.
2. The EUT was placed on a turntable with 1.5m height.
3. The test distance between the receiving antenna and the EUT is 3 meter, while the receiving (test) antenna is kept at 1.5 meter height.
4. Set EUT in continuous transmitting with maximum output power.
5. The table was rotated from 0 to 360 degree to search the highest radiated emission.
6. Repeat step 3 to 5 for each polarization and channel to find the worst emission level.
7. The results obtained are compared to the limits in order to prove compliance with the requirement.

Test Configuration

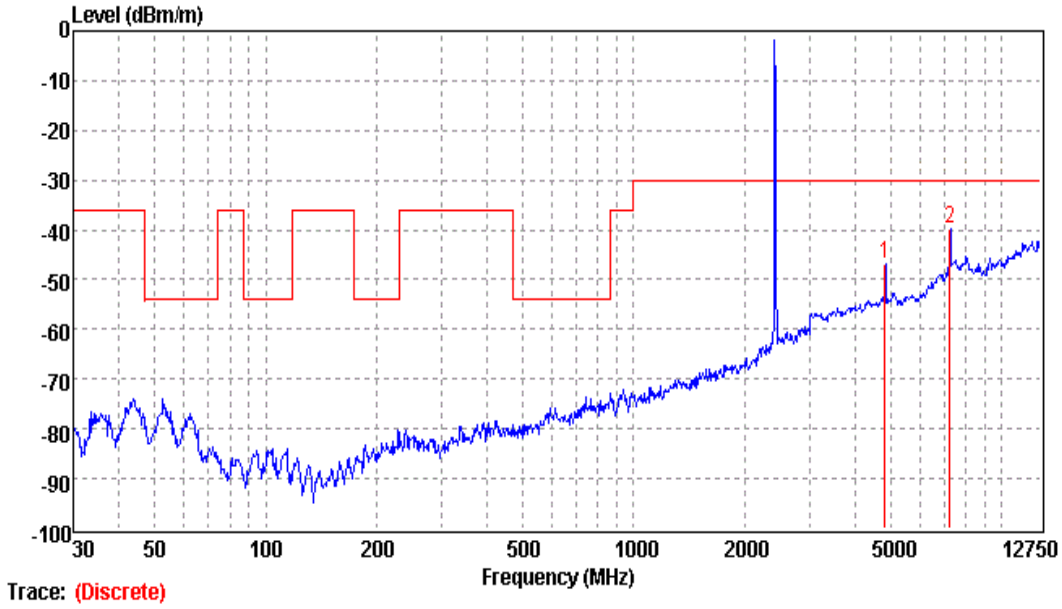
Effective Radiated Power measurement (30 MHz to 12.75 GHz)



Test Results

Remark: We test all modulation type, and recorded the worst case at 802.11b mode for WIFI test and GFSK DH5 mode for BT3.0 test.

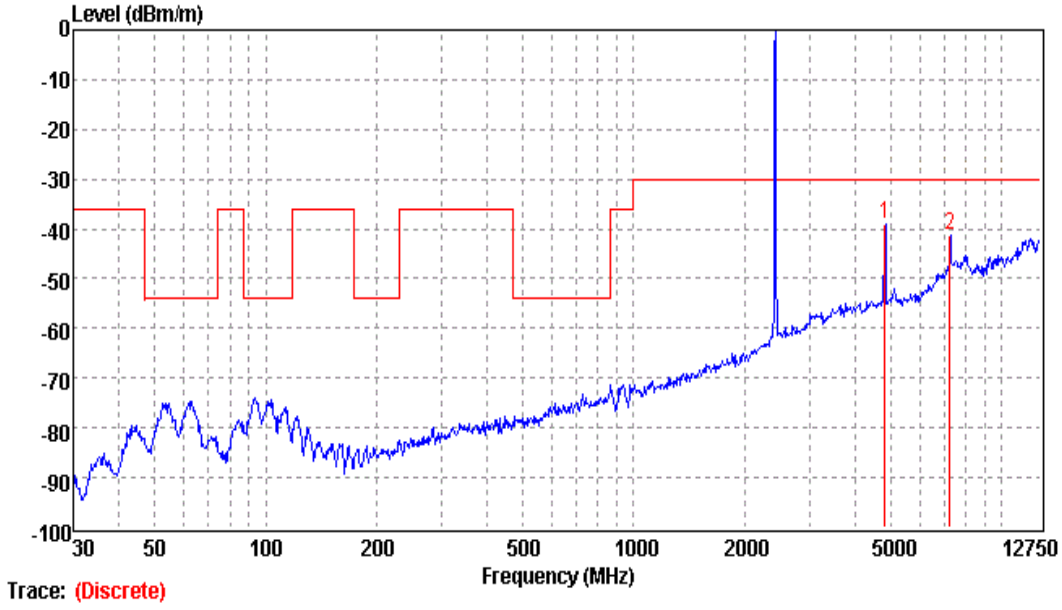
802.11b			
Channel:	CH01	Polarity:	Horizontal



Trace: (Discrete)

Mark	Frequency MHz	Level dBm	Factor dB	Reading dBm	Limit dB	Margin dB	Polarization	Detector
1	4825.23	-46.75	14.27	-61.02	-30.00	16.75	HORIZONTAL	Peak
2	7231.75	-39.68	23.75	-63.43	-30.00	9.68	HORIZONTAL	Peak

Channel:	CH01	Polarity:	Vertical

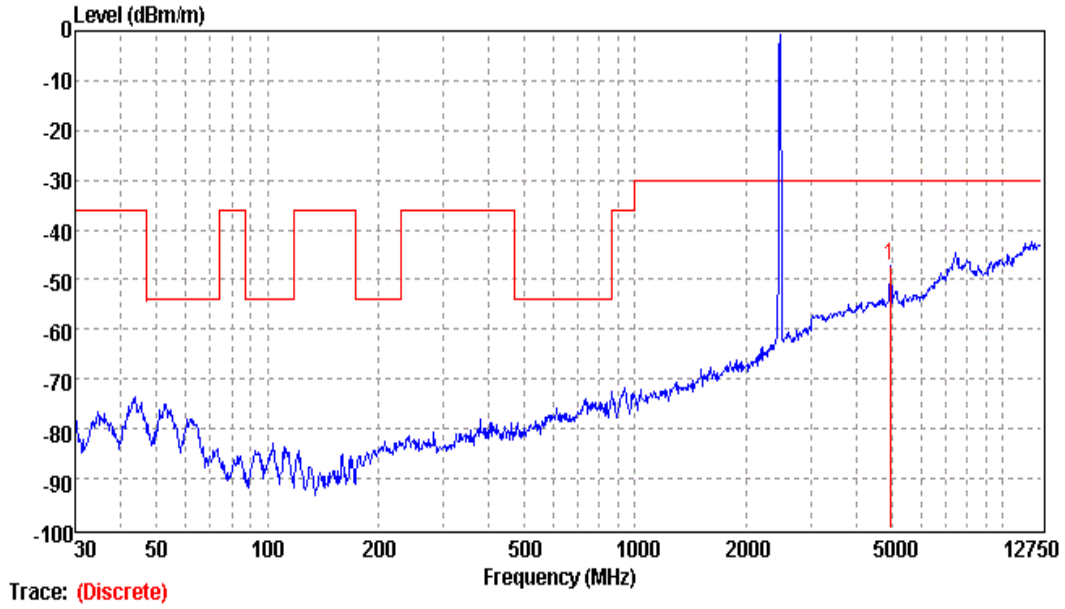


Trace: (Discrete)

Mark	Frequency MHz	Level dBm	Factor dB	Reading dBm	Limit dB	Margin dB	Polarization	Detector
1	4818.24	-39.04	13.98	-53.02	-30.00	9.04	VERTICAL	Peak
2	7242.24	-41.18	23.92	-65.10	-30.00	11.18	VERTICAL	Peak

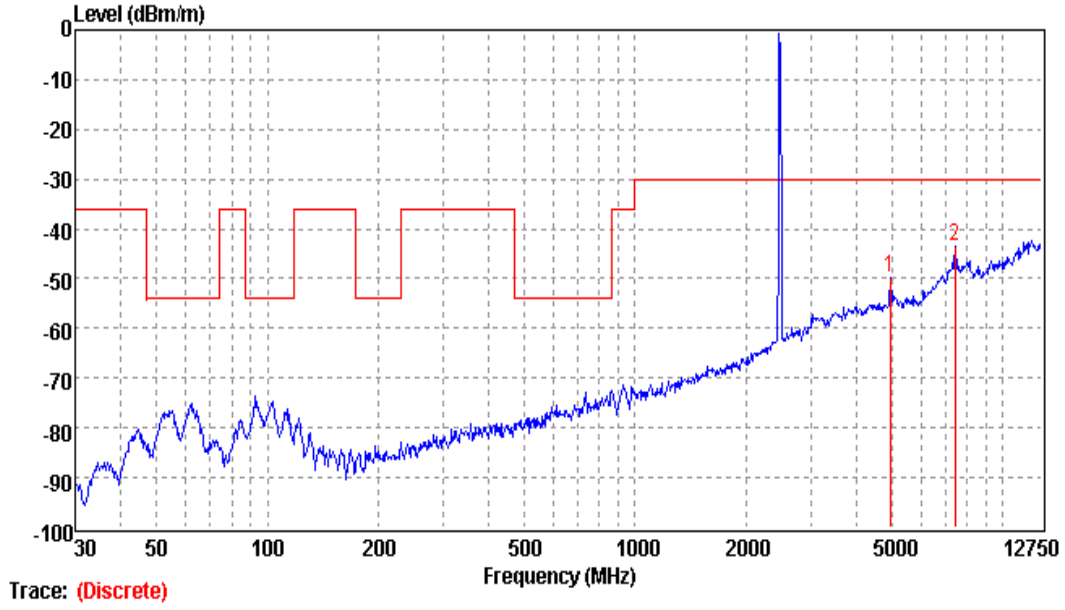
802.11b

Channel:	*CH13*	*Polarity:*	*Horizontal*



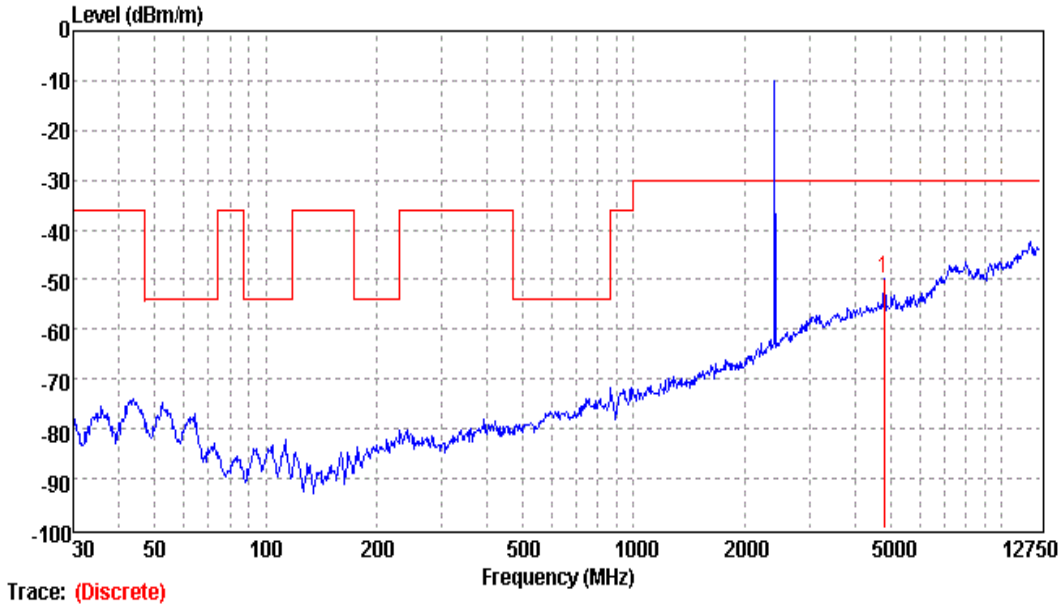
Mark	Frequency MHz	Level dBm	Factor dB	Reading dBm	Limit dB	Margin dB	Polarization	Detector
1	4938.51	-47.38	14.78	-62.16	-30.00	17.38	HORIZONTAL	Peak

Channel:	*CH13*	*Polarity:*	*Vertical*



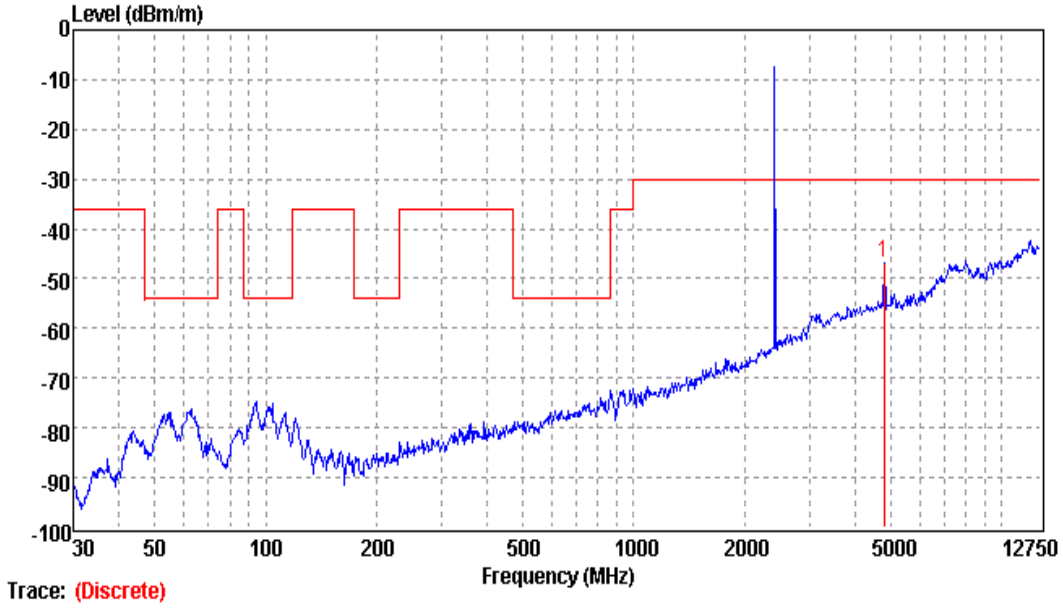
Mark	Frequency MHz	Level dBm	Factor dB	Reading dBm	Limit dB	Margin dB	Polarization	Detector
1	4938.51	-49.85	14.30	-64.15	-30.00	19.85	VERTICAL	Peak
2	7412.26	-43.53	24.33	-67.86	-30.00	13.53	VERTICAL	Peak

BT 3.0 GFSK			
Channel:	CH00	Polarity:	Horizontal



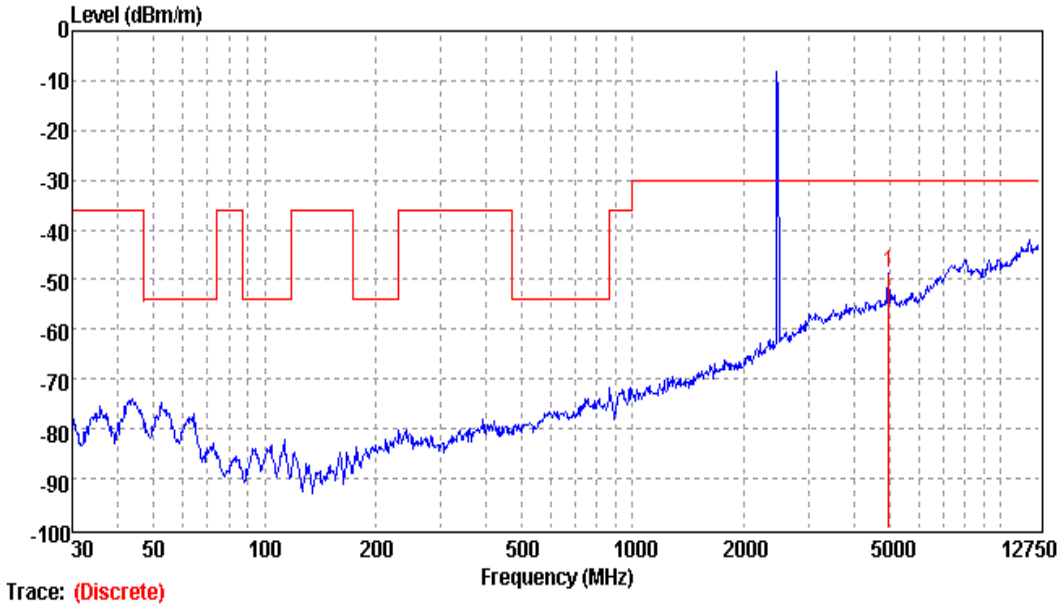
Mark	Frequency MHz	Level dBm	Factor dB	Reading dBm	Limit dB	Margin dB	Polarization	Detector
1	4804.28	-49.92	14.17	-64.09	-30.00	19.92	HORIZONTAL	Peak

Channel:	CH00	Polarity:	Vertical



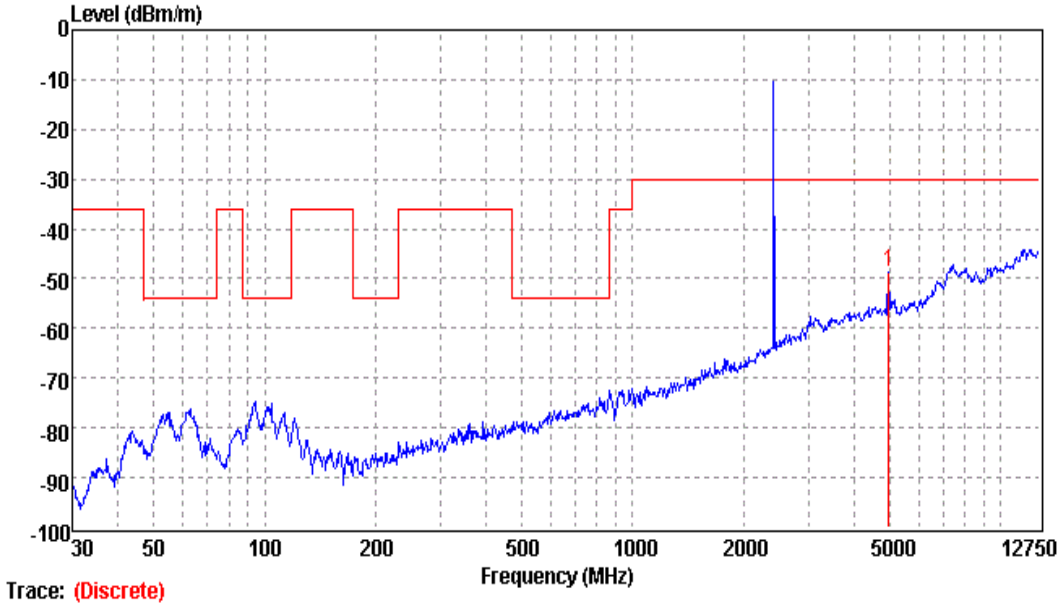
Mark	Frequency MHz	Level dBm	Factor dB	Reading dBm	Limit dB	Margin dB	Polarization	Detector
1	4804.28	-46.92	13.97	-60.89	-30.00	16.92	VERTICAL	Peak

BT 3.0 GFSK			
Channel:	CH78	Polarity:	Horizontal



Mark	Frequency MHz	Level dBm	Factor dB	Reading dBm	Limit dB	Margin dB	Polarization	Detector
1	4960.04	-48.55	14.87	-63.42	-30.00	18.55	HORIZONTAL	Peak

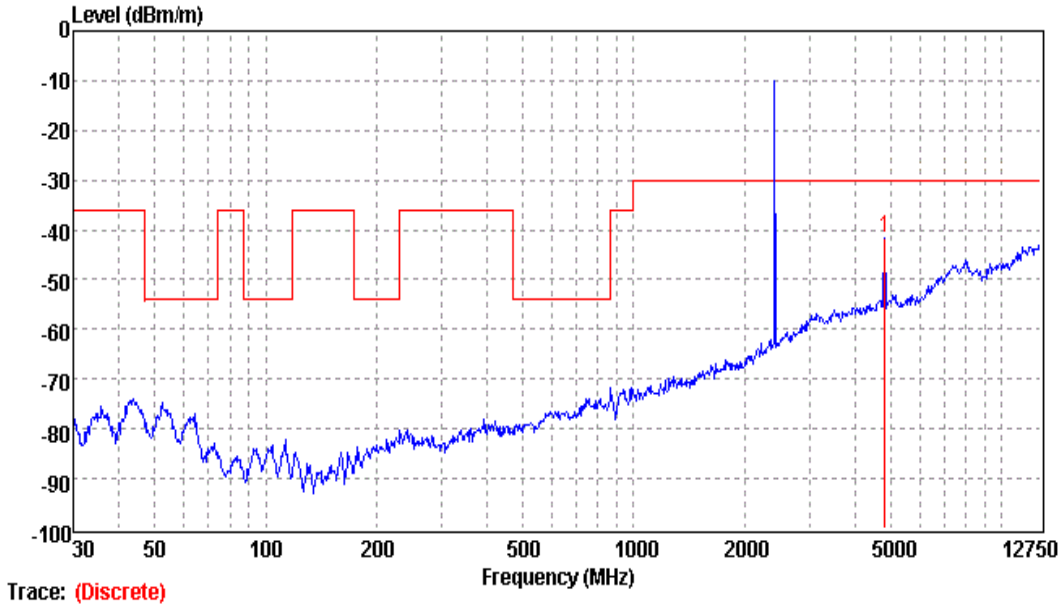
Channel:	CH78	Polarity:	Vertical



Mark	Frequency MHz	Level dBm	Factor dB	Reading dBm	Limit dB	Margin dB	Polarization	Detector
1	4960.04	-48.66	14.46	-63.12	-30.00	18.66	VERTICAL	Peak

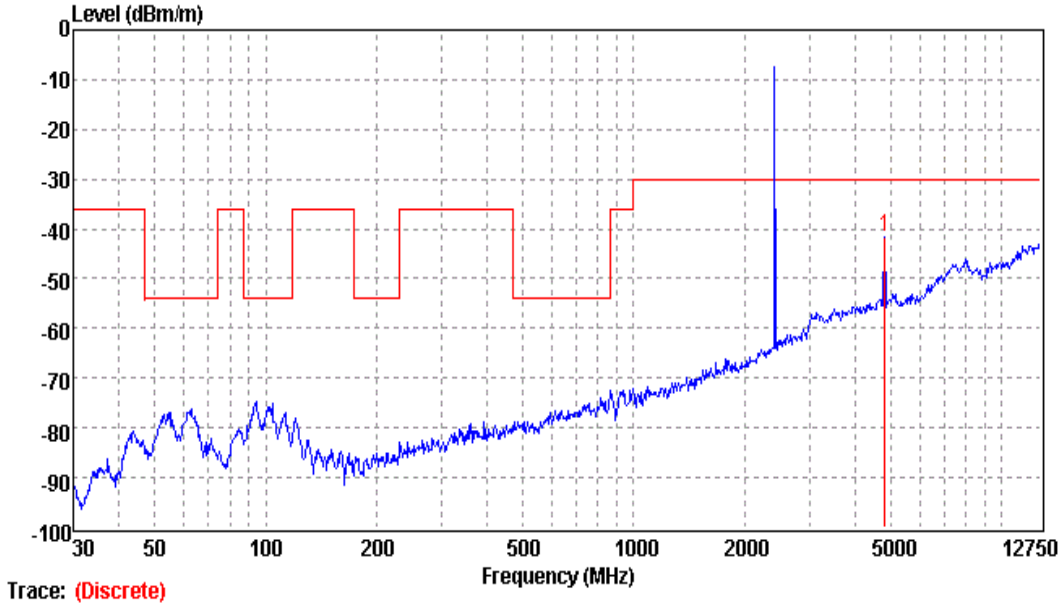
BT 4.0

Channel:	CH00	Polarity:	Horizontal



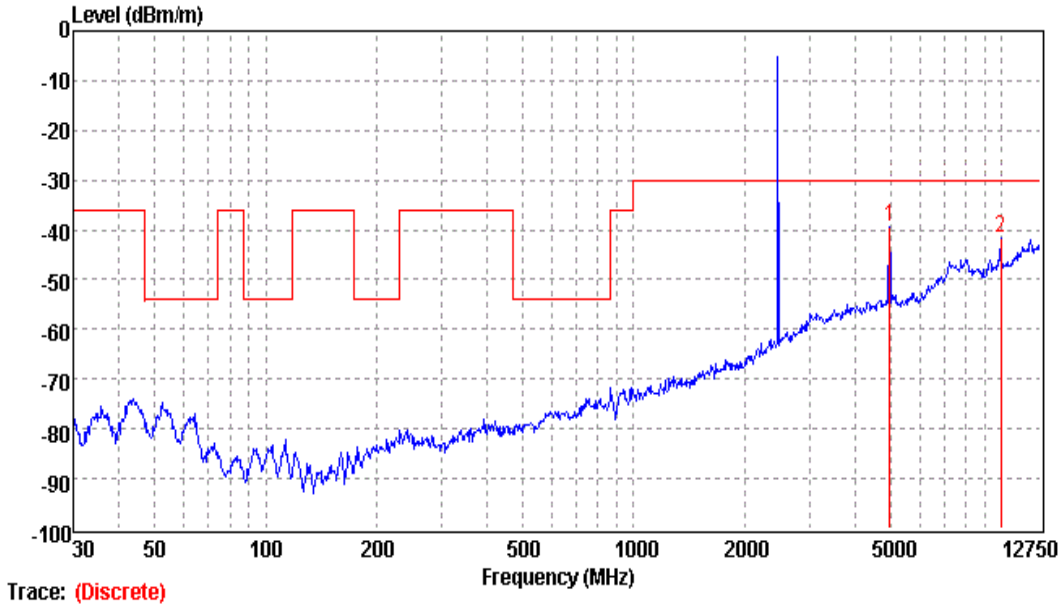
Mark	Frequency MHz	Level dBm	Factor dB	Reading dBm	Limit dB	Margin dB	Polarization	Detector
1	4812.16	-41.66	14.21	-55.87	-30.00	11.66	HORIZONTAL	Peak

Channel:	CH00	Polarity:	Vertical



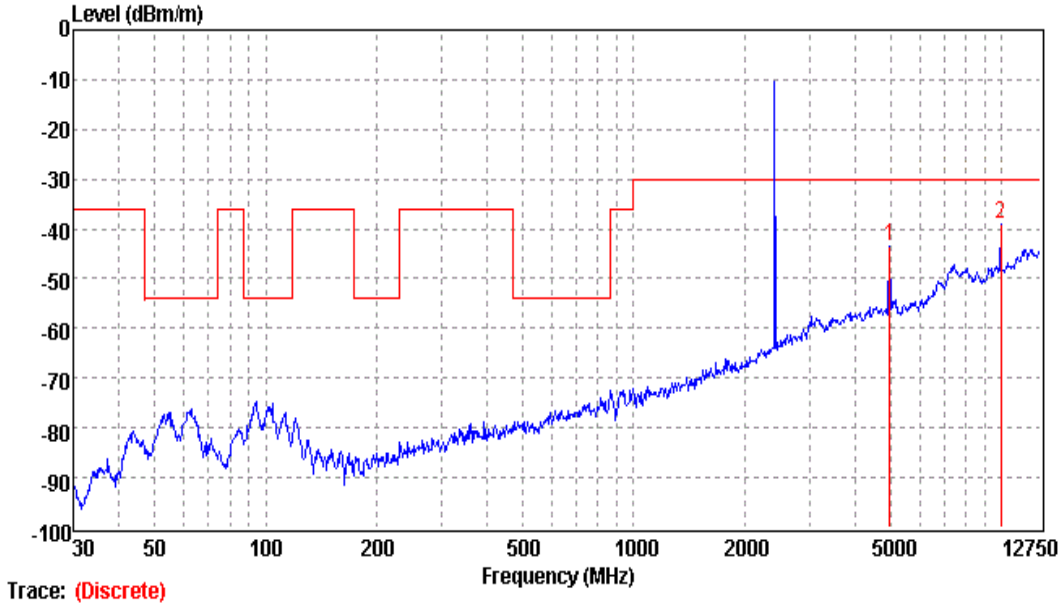
Mark	Frequency MHz	Level dBm	Factor dB	Reading dBm	Limit dB	Margin dB	Polarization	Detector
1	4812.16	-41.66	13.97	-55.63	-30.00	11.66	VERTICAL	Peak

BT 4.0			
Channel:	CH39	Polarity:	Horizontal



Mark	Frequency MHz	Level dBm	Factor dB	Reading dBm	Limit dB	Margin dB	Polarization	Detector
1	4960.00	-39.55	14.87	-54.42	-30.00	9.55	HORIZONTAL	Peak
2	9948.24	-41.51	24.48	-65.99	-30.00	11.51	HORIZONTAL	Peak

Channel:	CH39	Polarity:	Vertical



Mark	Frequency MHz	Level dBm	Factor dB	Reading dBm	Limit dB	Margin dB	Polarization	Detector
1	4960.00	-43.66	14.46	-58.12	-30.00	13.66	VERTICAL	Peak
2	9948.24	-38.92	24.37	-63.29	-30.00	8.92	VERTICAL	Peak

3.10 Receiver spurious emissions

LIMIT

ETSI EN 300 328 (V1.9.1) Sub-clause 4.3.1.11.3 & 4.3.2.10.3

The spurious emissions of the receiver shall not exceed the values given below:

Spurious emission limits for receivers

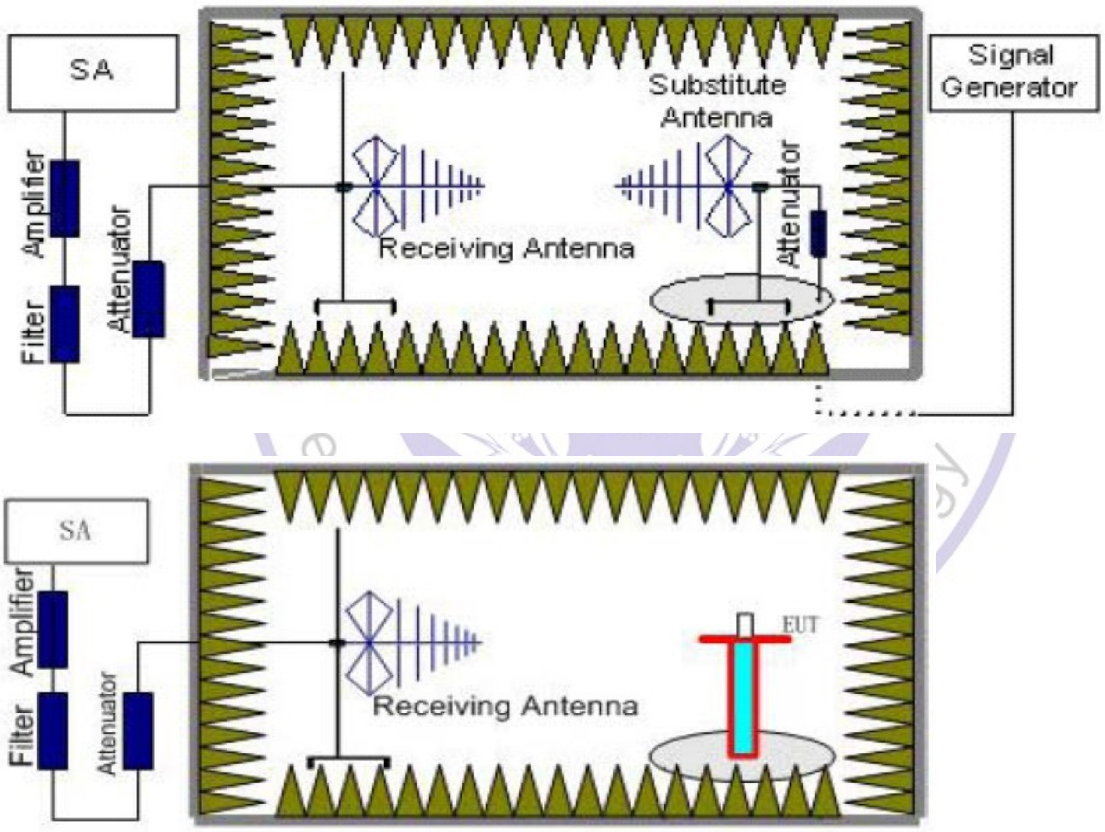
Frequency	Maximum power, e.r.p.	Measurement bandwidth
30 MHz to 1 GHz	-57 dBm	100 KHz
30 MHz to 12.75 GHz	-47 dBm	1 MHz

Test Procedure

The same as clause 3.9

Test Configuration

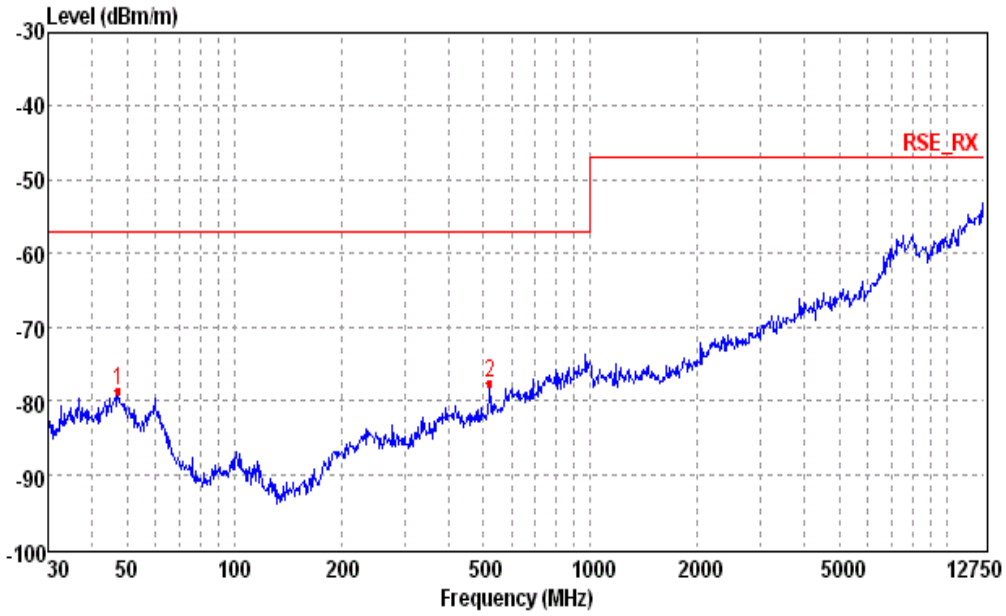
Effective Radiated Power measurement (30 MHz to 12.75 GHz)



Test Results

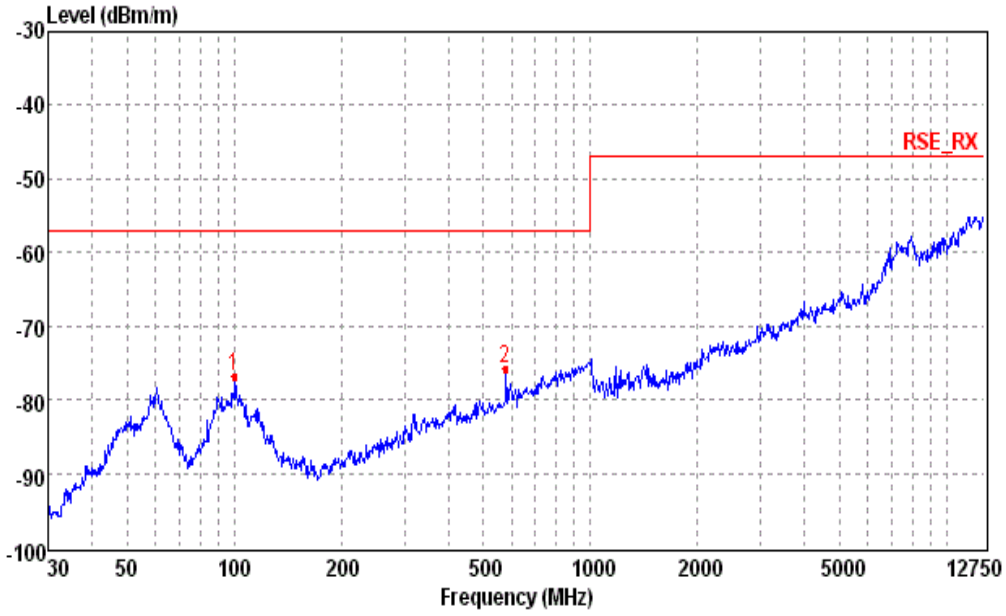
Remark: We test all modulation type, and recorded the worst case at 802.11b mode for WIFI test and GFSK DH5 mode for BT3.0 test.

802.11b			
Channel:	*CH01*	*Polarity:*	*Horizontal*



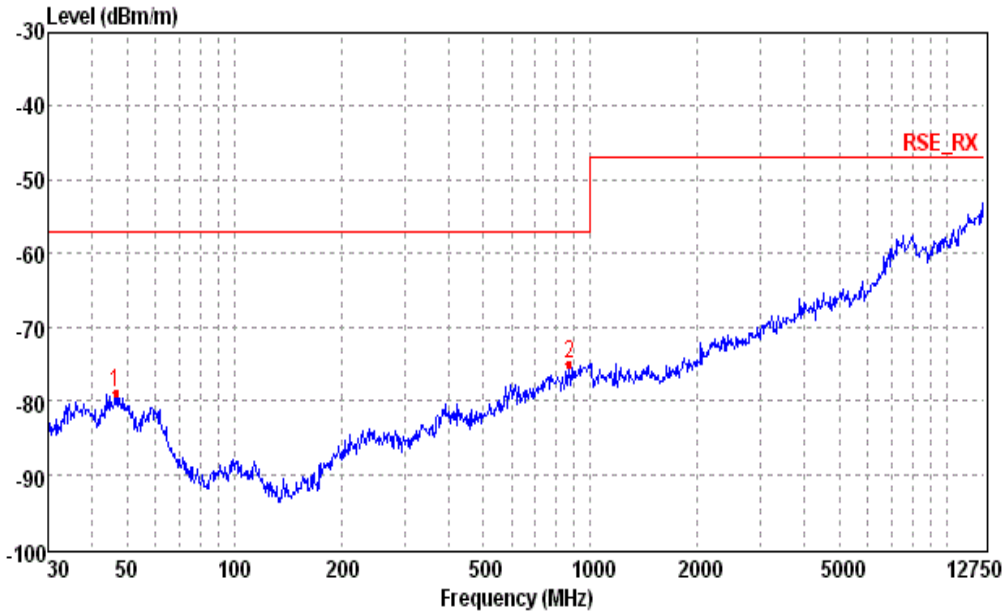
Mark	Frequency MHz	Level dBm	Factor dB	Reading dBm	Limit dB	Margin dB	Polarization	Det.
1	47.22	-78.75	-0.47	-78.28	-57.00	21.75	HORIZONTAL	Peak
2	521.44	-77.66	0.84	-78.50	-57.00	20.66	HORIZONTAL	Peak

Channel:	*CH01*	*Polarity:*	*Vertical*



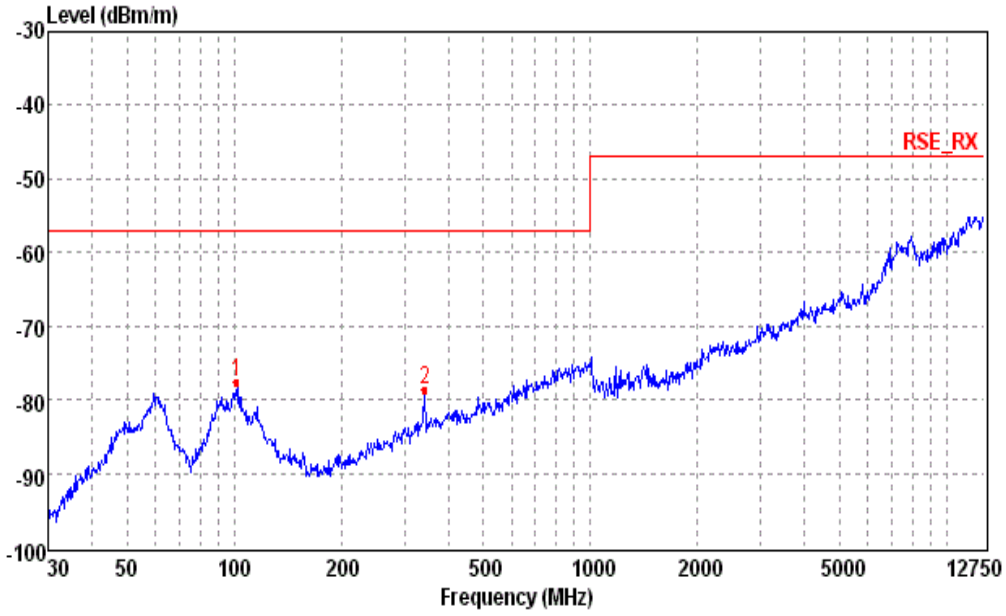
Mark	Frequency MHz	Level dBm	Factor dB	Reading dBm	Limit dB	Margin dB	Polarization	Det.
1	100.22	-76.86	1.08	-77.94	-57.00	19.86	VERTICAL	Peak
2	577.43	-75.67	2.02	-77.69	-57.00	18.67	VERTICAL	Peak

802.11b			
Channel:	*CH13*	*Polarity:*	*Horizontal*



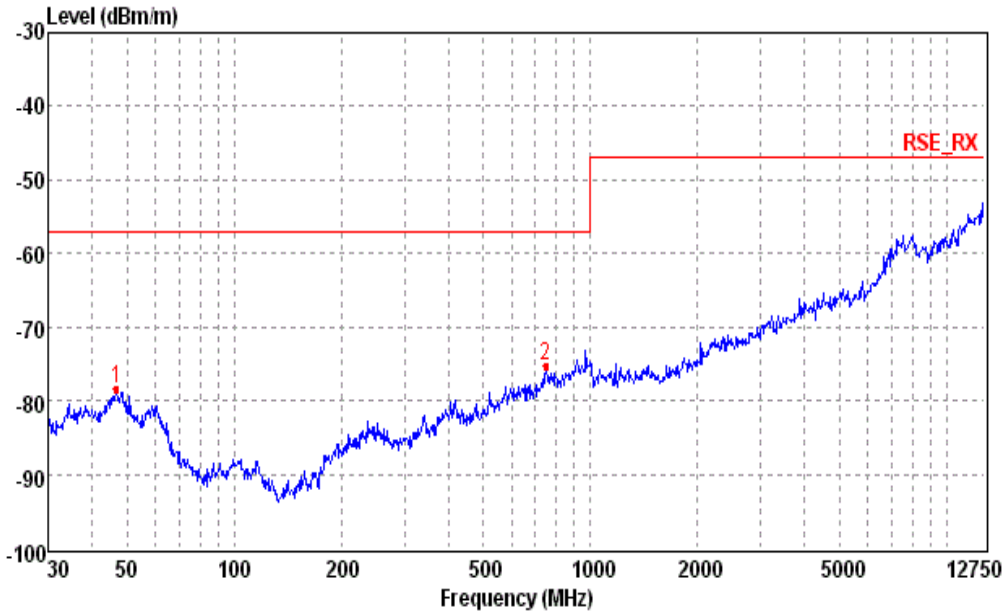
Mark	Frequency MHz	Level dBm	Factor dB	Reading dBm	Limit dB	Margin dB	Polarization	Det.
1	46.40	-78.81	-0.45	-78.36	-57.00	21.81	HORIZONTAL	Peak
2	871.32	-74.99	5.78	-80.77	-57.00	17.99	HORIZONTAL	Peak

Channel:	*CH13*	*Polarity:*	*Vertical*



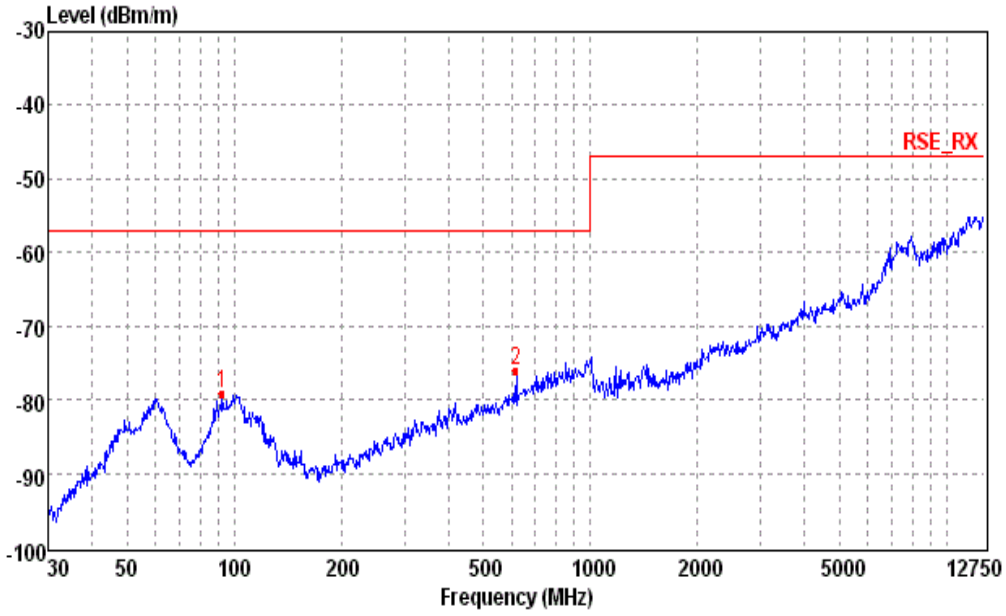
Mark	Frequency MHz	Level dBm	Factor dB	Reading dBm	Limit dB	Margin dB	Polarization	Det.
1	101.64	-77.72	0.86	-78.58	-57.00	20.72	VERTICAL	Peak
2	341.94	-78.54	-1.58	-76.96	-57.00	21.54	VERTICAL	Peak

BT 3.0 GFSK			
Channel:	*CH00*	*Polarity:*	*Horizontal*



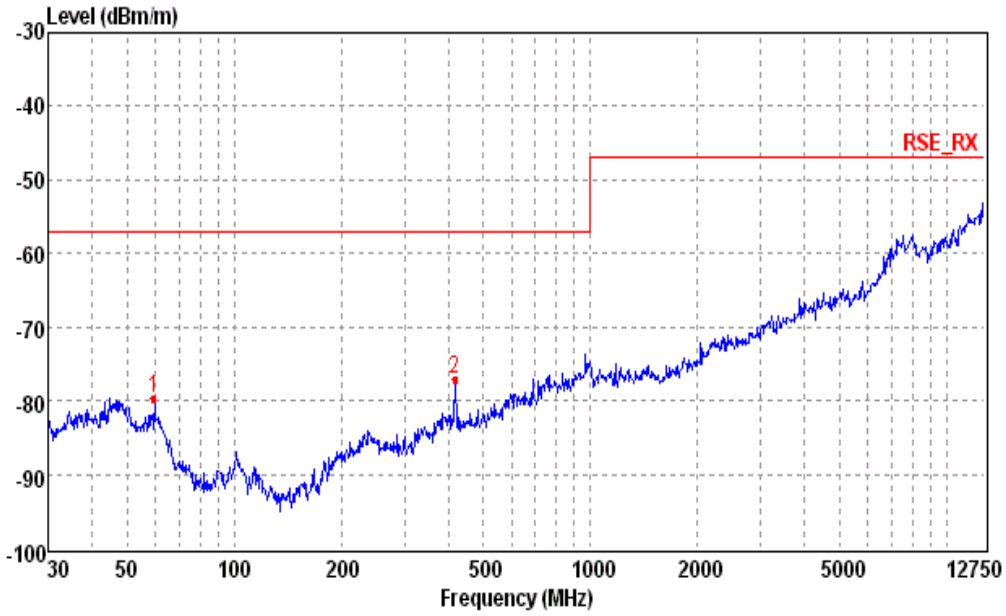
Mark	Frequency MHz	Level dBm	Factor dB	Reading dBm	Limit dB	Margin dB	Polarization	Det.
1	46.72	-78.32	-0.46	-77.86	-57.00	21.32	HORIZONTAL	Peak
2	749.05	-75.20	5.30	-80.50	-57.00	18.20	HORIZONTAL	Peak

Channel:	*CH00*	*Polarity:*	*Vertical*



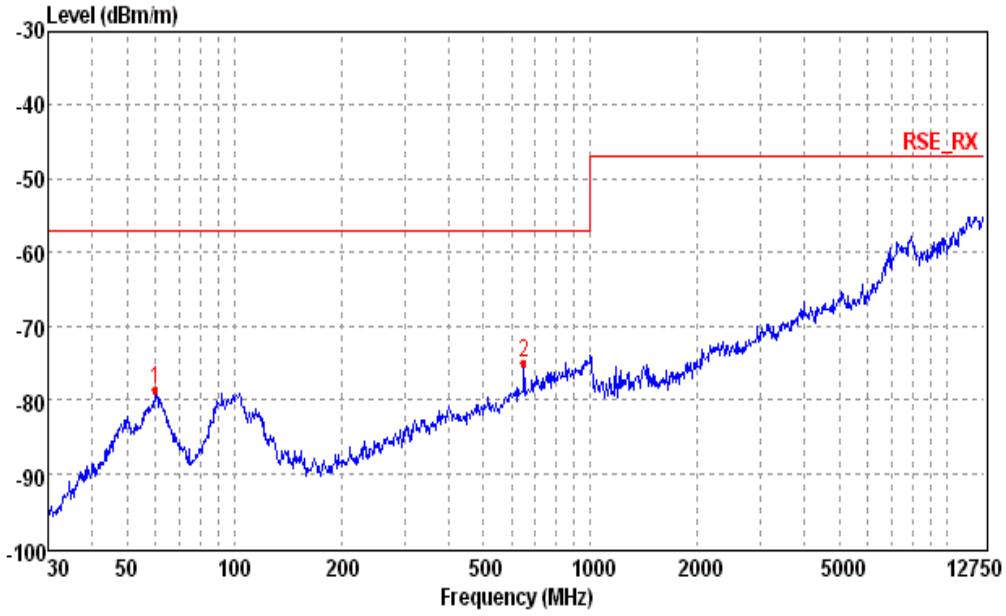
Mark	Frequency MHz	Level dBm	Factor dB	Reading dBm	Limit dB	Margin dB	Polarization	Det.
1	92.43	-79.31	0.29	-79.60	-57.00	22.31	VERTICAL	Peak
2	617.32	-76.06	2.82	-78.88	-57.00	19.06	VERTICAL	Peak

BT 3.0 GFSK			
Channel:	CH78	Polarity:	Horizontal



Mark	Frequency MHz	Level dBm	Factor dB	Reading dBm	Limit dB	Margin dB	Polarization	Det.
1	59.56	-79.72	-2.01	-77.71	-57.00	22.72	HORIZONTAL	Peak
2	416.36	-77.22	-0.25	-76.97	-57.00	20.22	HORIZONTAL	Peak

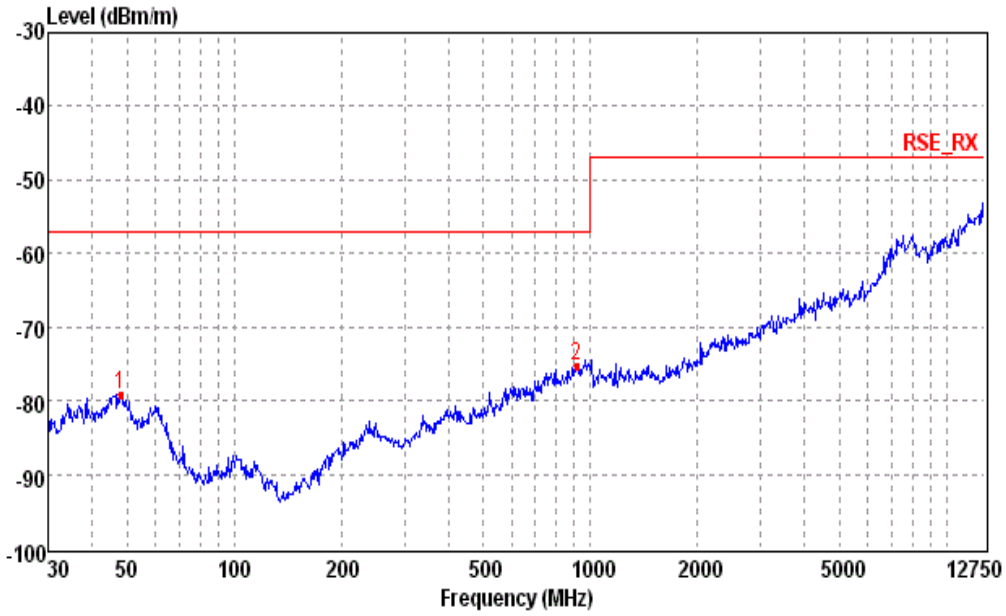
Channel:	CH78	Polarity:	Vertical



Mark	Frequency MHz	Level dBm	Factor dB	Reading dBm	Limit dB	Margin dB	Polarization	Det.
1	60.19	-78.74	-0.76	-77.98	-57.00	21.74	VERTICAL	Peak
2	648.48	-74.95	3.41	-78.36	-57.00	17.95	VERTICAL	Peak

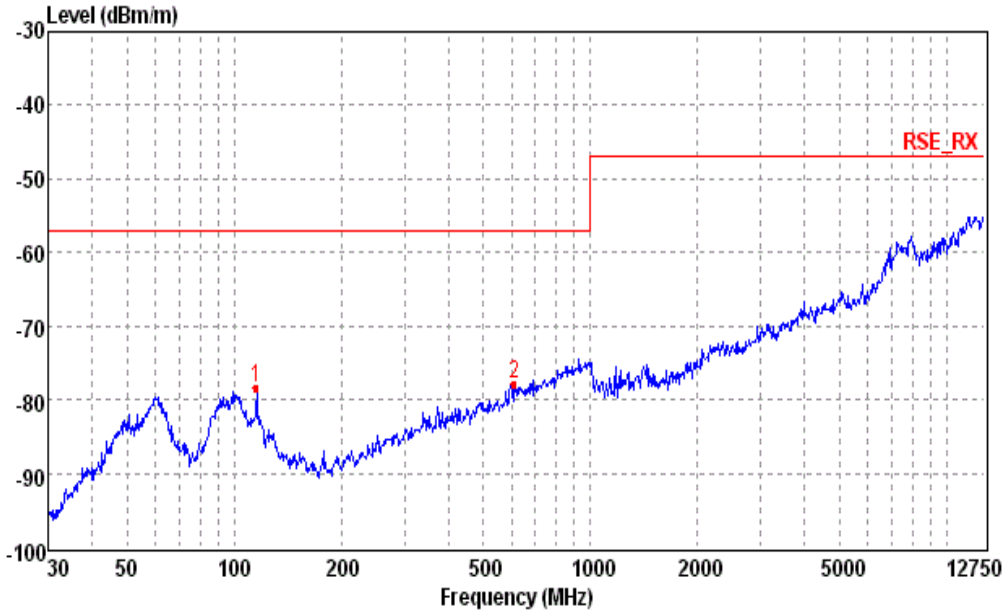
BT 4.0

Channel:	CH00	Polarity:	Horizontal



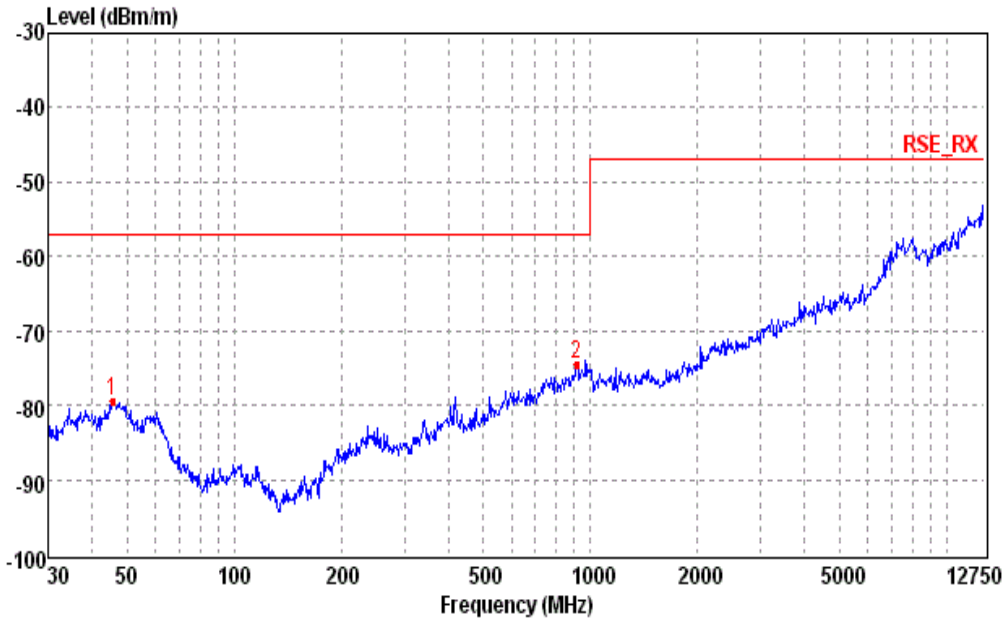
Mark	Frequency MHz	Level dBm	Factor dB	Reading dBm	Limit dB	Margin dB	Polarization	Det.
1	48.06	-79.11	-0.50	-78.61	-57.00	22.11	HORIZONTAL	Peak
2	915.29	-75.37	6.63	-82.00	-57.00	18.37	HORIZONTAL	Peak

Channel:	CH00	Polarity:	Vertical



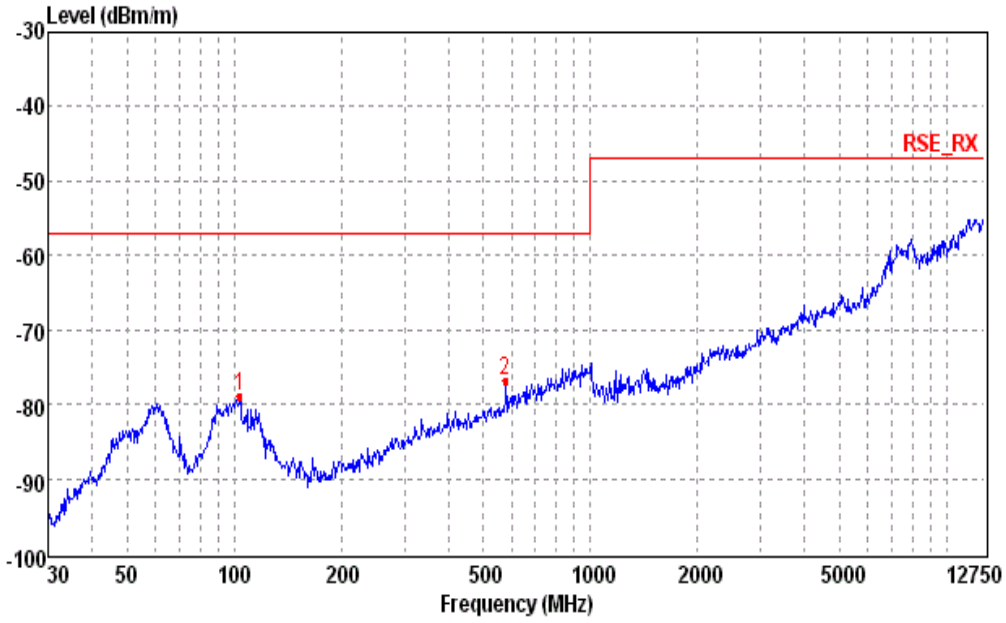
Mark	Frequency MHz	Level dBm	Factor dB	Reading dBm	Limit dB	Margin dB	Polarization	Det.
1	115.36	-78.29	-1.41	-76.88	-57.00	21.29	VERTICAL	Peak
2	610.85	-77.85	2.78	-80.63	-57.00	20.85	VERTICAL	Peak

BT 4.0			
Channel:	CH39	Polarity:	Horizontal



Mark	Frequency MHz	Level dBm	Factor dB	Reading dBm	Limit dB	Margin dB	Polarization	Det.
1	45.43	-79.37	-0.42	-78.95	-57.00	22.37	HORIZONTAL	Peak
2	915.29	-74.44	6.63	-81.07	-57.00	17.44	HORIZONTAL	Peak

Channel:	CH39	Polarity:	Vertical



Mark	Frequency MHz	Level dBm	Factor dB	Reading dBm	Limit dB	Margin dB	Polarization	Det.
1	103.81	-79.00	0.53	-79.53	-57.00	22.00	VERTICAL	Peak
2	577.43	-76.79	2.02	-78.81	-57.00	19.79	VERTICAL	Peak

3.11 Adaptivity and Receiver Blocking

Limits

For Requirements and Limits please refer to ETSI EN 300 328 1.9.1 Sub - clause 4.3.1.7.2.2 & 4.3.1.7.3.2 & 4.3.2.6.2.2 & 4.3.2.6.3.2.

Test Procedure

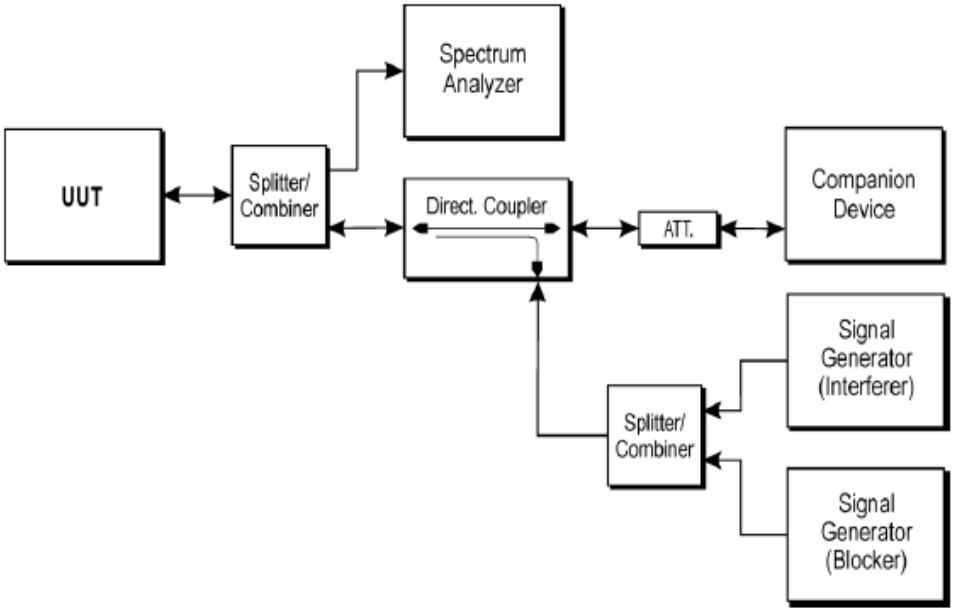
1. The measurement procedure follows the clause 5.3.7.2.1 of the ETSI EN 300 328 V1.9.1 (2015-02).
2. For conducted measurements on device with multiple transmit chains and receive chains. The power splitter/combiner shall be used to combine all the transmit/receive chains (antenna outputs) into a single test point. The insertion loss of the power splitter/combiner shall be taken into account.
3. Interference signal shall be a100 % duty cycle interference signal is injected on the current operating channel of the UUT. This interference signal shall meet the requirements as follow:

   The 99 % bandwidth (the bandwidth containing 99 % of the power) of this inference signal shall be equal to 120 % of the Occupied Channel Bandwidth of the UUT with a minimum of 5 MHz, while the difference between the lowest and highest level within the Occupied Channel Bandwidth of the UUT shall be maximum 4 dB.
4. Blocking signal shell be a 100 % duty cycle CW signal, and The frequency and level shell be set as follow:

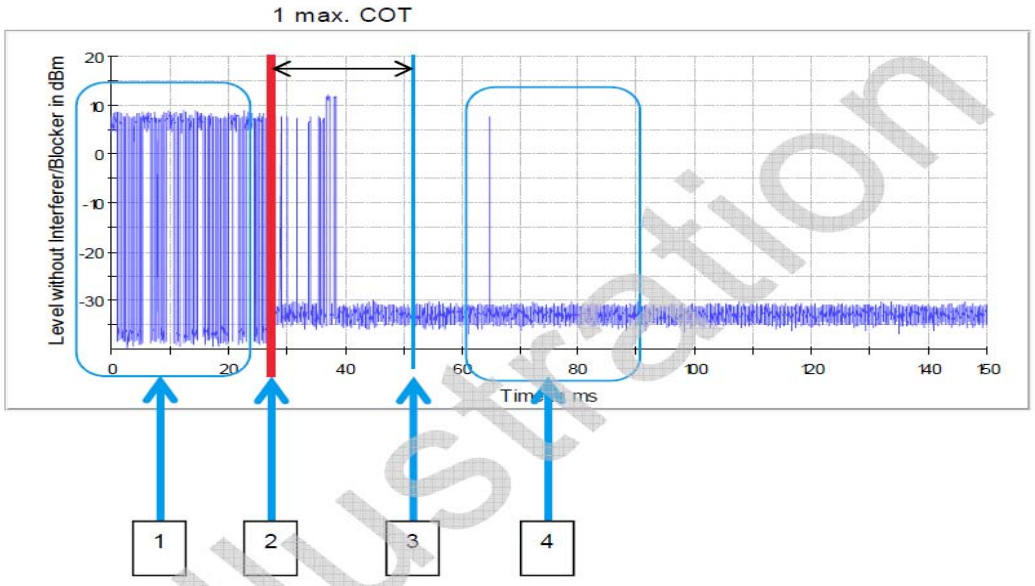
Equipment Type (LBT / non- LBT)	Wanted signal mean power from companion device	Blocking signal frequency [MHz]	Blocking signal power [dBm]	Type of interfering signal
LBT	sufficient to maintain the link (see note 2)	2 395 or 2 488,5 (see note 1)	-35	CW
Non-LBT	-30 dB			
NOTE 1: The highest blocking frequency shall be used for testing the lowest operating hopping frequency, while the lowest blocking frequency shall be used for testing the highest hopping frequency. NOTE 2: A typical value which can be used in most cases is -50 dBm/MHz.				

5. The test not applicable to none-adaptive equipment and adaptive equipment which maximum RF Output power level is less than 10 dBm e.i.r.p.

Test Configuration

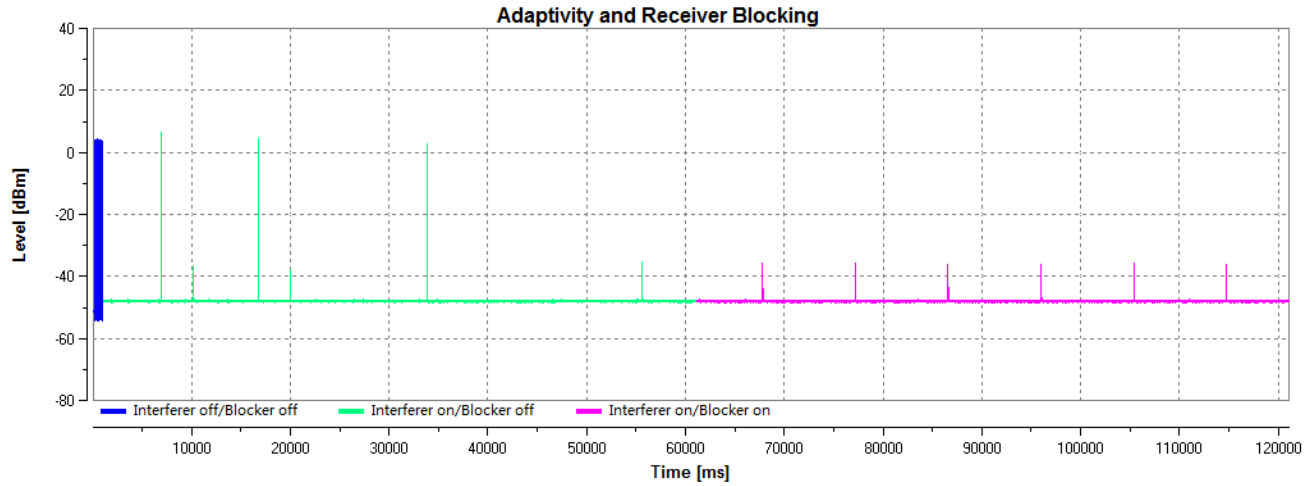


Adaptivity Test schematic graphic



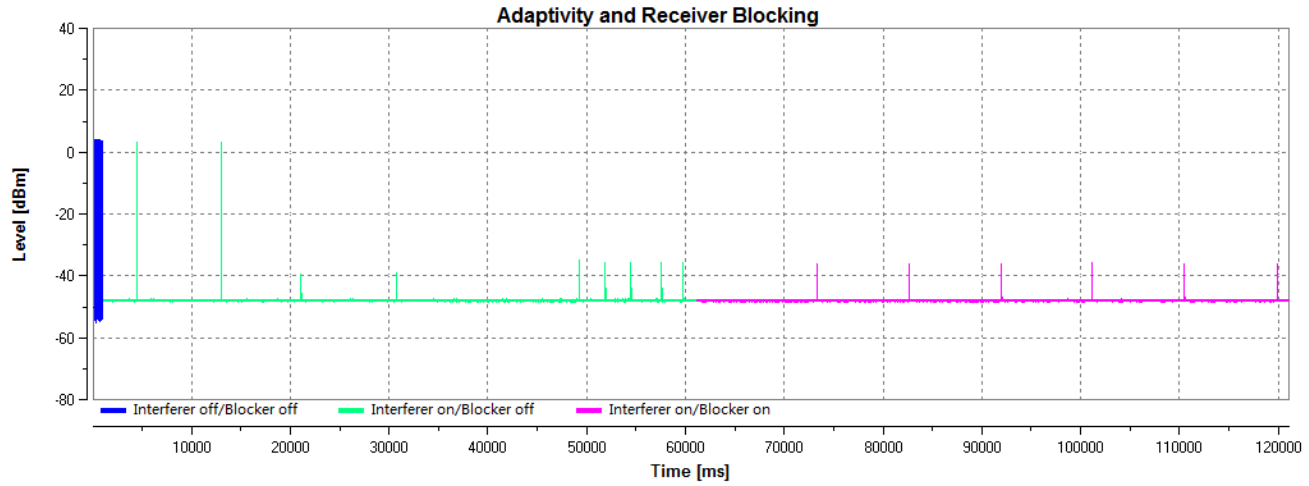
1. Reference measurement (interferer off / Blocker off trace)
2. Interferer switched on (rise of the noise floor)
3. Arming of the video trigger one max. COT after interferer is switched on
4. Monitoring measurement triggered by the short signaling (interferer on / Blocker off traceor interferer on / Blocker on trace)

Mode:	802.11b	Channel:	01



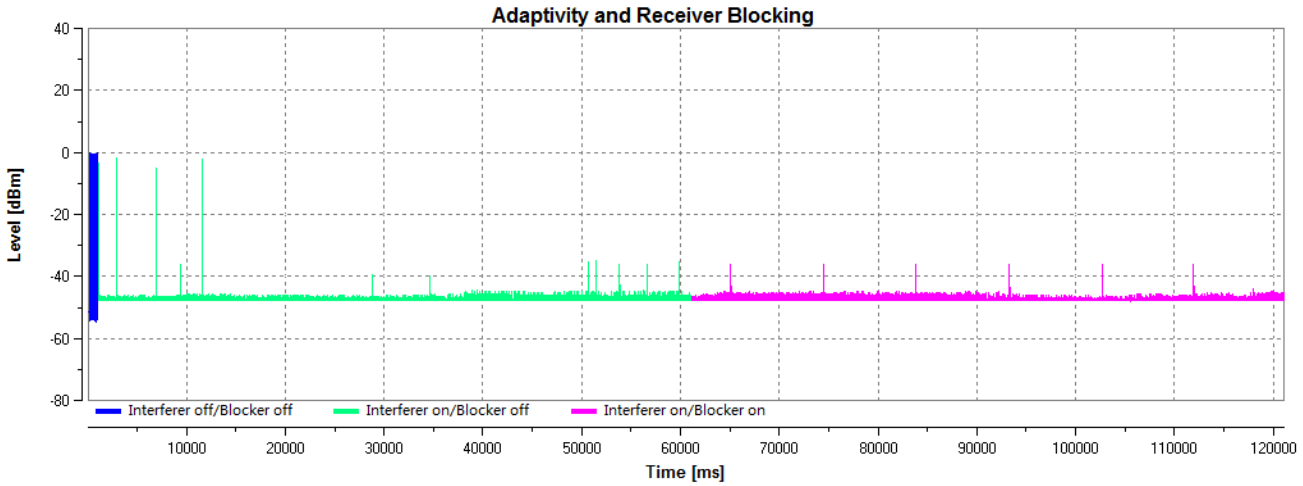
Step1	**Interferer signal**	**Blocking single**	**COT (ms)**	**CCA Time(ms)**	**Result**	**Comment**
	OFF	OFF	1.715	0.077	PASS	Sequence < 13 ms
Step2	**Interferer signal**	**Blocking single**	**Burst observation(ms)**		**Result**	**Comment**
	ON	OFF	1.224		PASS	Burst < 5 ms; Short Signaling ok
Step3	ON	ON	0.00		PASS	Power < 10dBm; no bursts found

Mode:	802.11b	Channel:	13



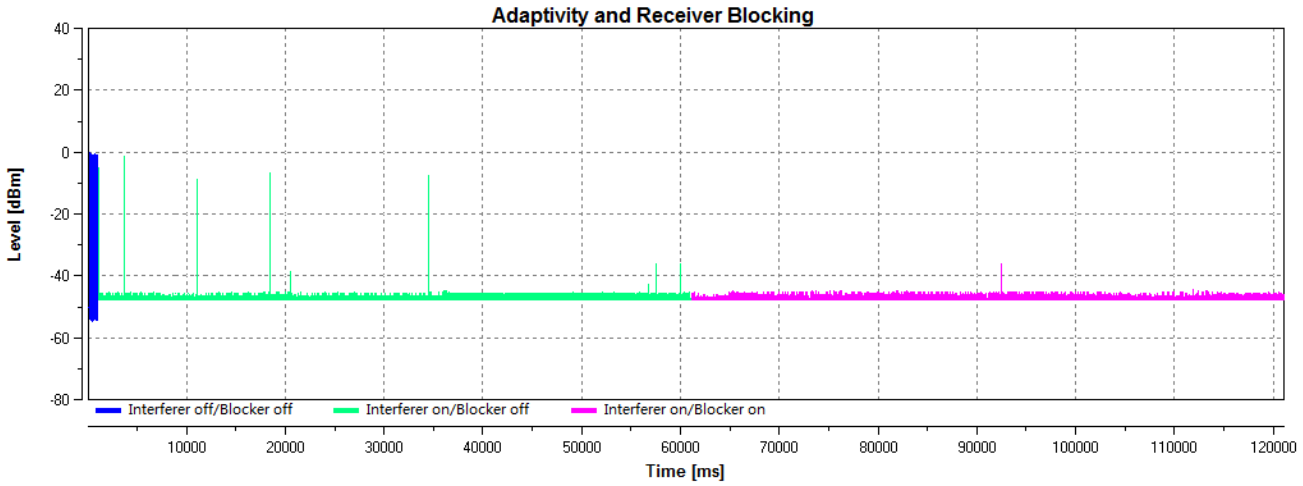
Step1	**Interferer signal**	**Blocking single**	**COT (ms)**	**CCA Time(ms)**	**Result**	**Comment**
	OFF	OFF	0.287	0.074	PASS	Sequence < 13 ms
Step2	**Interferer signal**	**Blocking single**	**Burst observation(ms)**		**Result**	**Comment**
	ON	OFF	0.987		PASS	Burst < 5 ms; Short Signaling ok
Step3	ON	ON	0		PASS	Power < 10dBm; no bursts found

Mode:	802.11g	Channel:	01



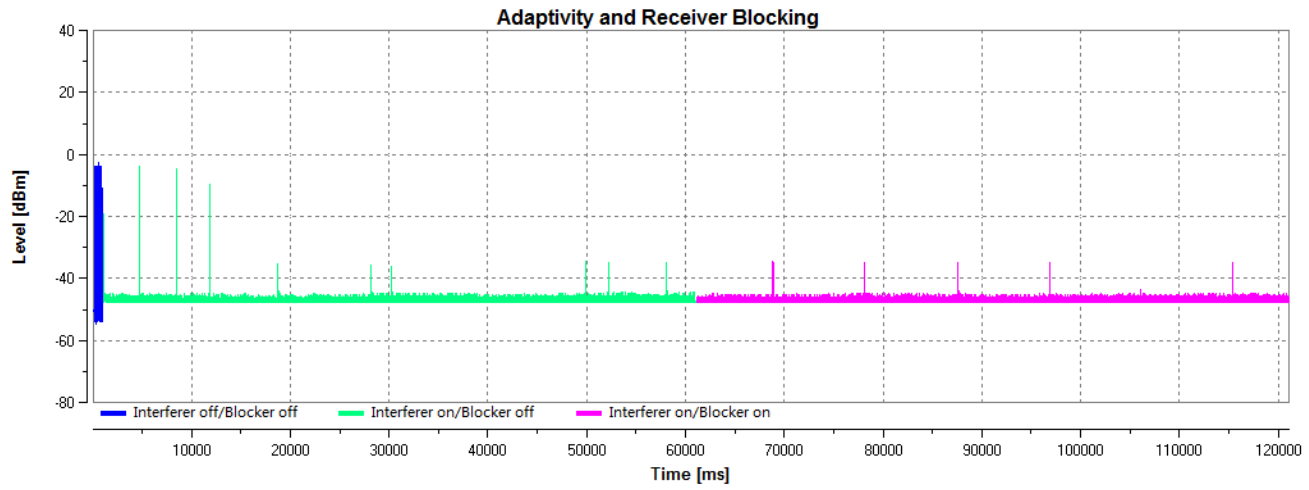
Step1	**Interferer signal**	**Blocking single**	**COT (ms)**	**CCA Time(ms)**	**Result**	**Comment**
	OFF	OFF	0.217	0.054	PASS	Sequence < 13 ms
Step2	**Interferer signal**	**Blocking single**	**Burst observation(ms)**		**Result**	**Comment**
	ON	OFF	2.357		PASS	Burst < 5 ms; Short Signaling ok
Step3	ON	ON	0		PASS	Power < 10dBm; no bursts found

Mode:	802.11g	Channel:	13



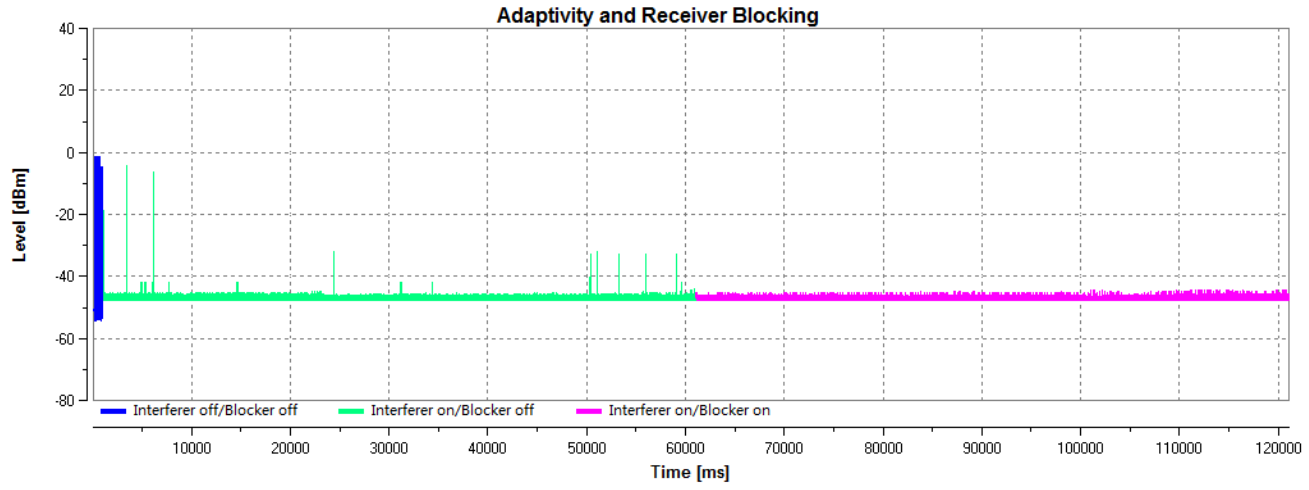
Step1	**Interferer signal**	**Blocking single**	**COT (ms)**	**CCA Time(ms)**	**Result**	**Comment**
	OFF	OFF	0.196	0.041	PASS	Sequence < 13 ms
Step2	**Interferer signal**	**Blocking single**	**Burst observation(ms)**		**Result**	**Comment**
	ON	OFF	2.663		PASS	Burst < 5 ms; Short Signaling ok
Step3	ON	ON	0		PASS	Power < 10dBm; no bursts found

Mode:	802.11n(20MHz)	Channel:	01



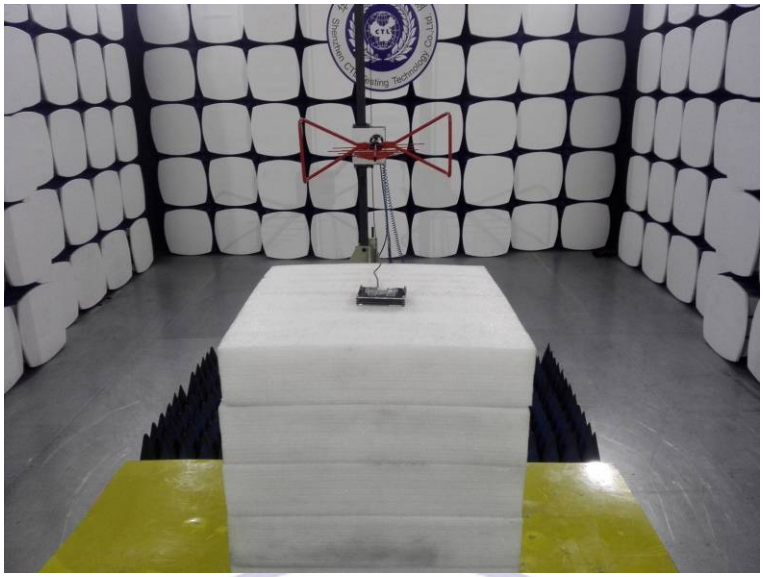
Step1	**Interferer signal**	**Blocking single**	**COT (ms)**	**CCA Time(ms)**	**Result**	**Comment**
	OFF	OFF	0.341	0.047	PASS	Sequence < 13 ms
Step2	**Interferer signal**	**Blocking single**	**Burst observation(ms)**		**Result**	**Comment**
	ON	OFF	2.157		PASS	Burst < 5 ms; Short Signaling ok
Step3	ON	ON	0		PASS	Power < 10dBm; no bursts found

Mode:	802.11n(20MHz)	Channel:	13



Step1	**Interferer signal**	**Blocking single**	**COT (ms)**	**CCA Time(ms)**	**Result**	**Comment**
	OFF	OFF	0.381	0.032	PASS	Sequence < 13 ms
Step2	**Interferer signal**	**Blocking single**	**Burst observation(ms)**		**Result**	**Comment**
	ON	OFF	1.198		PASS	Burst < 5 ms; Short Signaling ok
Step3	ON	ON	0		PASS	Power < 10dBm; no bursts found

4 Test Setup Photos of the EUT



5 External and Internal Photos of the EUT

Reference to the test report No. CTL1703042091-WE

********** End of Report **********

6 ANNEX E

Information as required by EN 300 328 V1.9.1, clause 5.3.1

In accordance with EN 300 328, clause 5.3.1, the following information is provided by the supplier.

a) The type of modulation used by the equipment:

☒FHSS
☒Other forms of modulation

b) In case of FHSS modulation:

- In case of non-Adaptive Frequency Hopping equipment:
  The number of Hopping Frequencies:
- In case of Adaptive Frequency Hopping Equipment:
  The maximum number of Hopping Frequencies: 79
  The minimum number of Hopping Frequencies: 15
- The (average) Dwell Time: 3.75ms

c) Adaptive / non-adaptive equipment:

☐Non-adaptive Equipment
☒Adaptive Equipment without the possibility to switch to a non-adaptive mode
☐Adaptive Equipment which can also operate in a non-adaptive mode

d) In case of adaptive equipment:

The Channel Occupancy Time implemented by the equipment: ms
☒The equipment has implemented an LBT based DAA mechanism

- In case of equipment using modulation different from FHSS:
  ☐The equipment is Frame Based equipment
  ☐The equipment is Load Based equipment
  ☐The equipment can switch dynamically between Frame Based and Load Based equipment
  The CCA time implemented by the equipment:

☐The equipment has implemented an non-LBT based DAA mechanism
☐The equipment can operate in more than one adaptive mode

e) In case of non-adaptive Equipment:

The maximum RF Output Power (e.i.r.p.): dBm
The maximum (corresponding) Duty Cycle: %
Equipment with dynamic behaviour, that behaviour is described here. (e.g. the different combinations of duty cycle and corresponding power levels to be declared):

f) The worst case operational mode for each of the following tests:

- RF Output Power
  802.11b 1Mbps, 802.11g 6Mbps, 802.11(HT20) 6.5Mbps,BLE, DH5,2DH5,3DH5
- Power Spectral Density
  802.11b 1Mbps, 802.11g 6Mbps, 802.11(HT20) 6.5Mbps,BLE
- Duty cycle, Tx-Sequence, Tx-gap
  N/A
- Dwell time, Minimum Frequency Occupation & Hopping Sequence (only for FHSS equipment)
  DH5,2DH5,3DH5
- Hopping Frequency Separation (only for FHSS equipment)
  DH5,2DH5,3DH5
- Medium Utilisation
  N/A
- Adaptivity & Receiver Blocking
  802.11b 1Mbps, 802.11g 6Mbps, 802.11(HT20) 6.5Mbps
- Occupied Channel Bandwidth

802.11b 1Mbps, 802.11g 6Mbps, 802.11(HT20) 6.5Mbps,BLE, DH5,2DH5,3DH5

- Transmitter unwanted emissions in the OOB domain
  802.11b 1Mbps, 802.11g 6Mbps, 802.11(HT20) 6.5Mbps,BLE, DH5,2DH5,3DH5
- Transmitter unwanted emissions in the spurious domain
  802.11b 1Mbps,BLE,DH5
- Receiver spurious emissions
  802.11b 1Mbps,BLE,DH5

g) The different transmit operating modes (tick all that apply):

☒Operating mode 1: Single Antenna Equipment
- ☒Equipment with only 1 antenna
- ☐Equipment with 2 diversity antennas but only 1 antenna active at any moment in time
- ☐Smart Antenna Systems with 2 or more antennas, but operating in a (legacy) mode where only 1 antenna is used. (e.g. IEEE 802.11™ [i.3] legacy mode in smart antenna systems)

☐Operating mode 2: Smart Antenna Systems - Multiple Antennas without beam forming
- ☐Single spatial stream / Standard throughput / (e.g. IEEE 802.11™ [i.3] legacy mode)
- ☐High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 1
- ☐High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 2

☐Operating mode 3: Smart Antenna Systems - Multiple Antennas with beam forming
- ☐Single spatial stream / Standard throughput (e.g. IEEE 802.11™ [i.3] legacy mode)
- ☐High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 1
- ☐High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 2

h) In case of Smart Antenna Systems:

- The number of Receive chains:
- The number of Transmit chains:
  - ☐Symmetrical power distribution
  - ☐Asymmetrical power distribution

In case of beam forming, the maximum (additional) beam forming gain:

i) Operating Frequency Range(s) of the equipment:

- Operating Frequency Range 1: 2412MHz to2472MHz
- Operating Frequency Range 2: 2402MHz to2480MHz

NOTE: Add more lines if more Frequency Ranges are supported.

j) Occupied Channel Bandwidth(s):

- Occupied Channel Bandwidth 1: 20MHz
- Occupied Channel Bandwidth 2: 2MHz

k) Type of Equipment (stand-alone, combined, plug-in radio device, etc.):

☒Stand-alone
☐Combined Equipment (Equipment where the radio part is fully integrated within another type of equipment)
☐Plug-in radio device (Equipment intended for a variety of host systems)
☐Other

l) The extreme operating conditions that apply to the equipment:

Operating temperature range: -20° C to +55° C
Operating voltage range: 207V to 254V ☒AC ☐DC
Details provided are for the: ☒stand-alone equipment
☐Combined (or host) equipment
☐Test jig

m) The intended combination(s) of the radio equipment power settings and one or more antenna assemblies and their corresponding e.i.r.p levels:

- Antenna Type:
  ☒Integral Antenna
  Antenna Gain: 0dBi
  If applicable, additional beamforming gain (excluding basic antenna gain): dB
  ☒Temporary RF connector provided
  ☐No temporary RF connector provided
  ☐Dedicated Antennas (equipment with antenna connector)
  ☐Single power level with corresponding antenna(s)
  ☐Multiple power settings and corresponding antenna(s)
  Number of different Power Levels:

Power Level 1:		dBm
Power Level 2:		dBm
Power Level 3:		dBm

n) For each of the Power Levels, provide the intended antenna assemblies, their corresponding gains (G) and the resulting e.i.r.p. levels also taking into account the beamforming gain (Y) if applicable

Power Level 1: dBm
Number of antenna assemblies provided for this power level:

Assembly #	Gain (dBi)	e.i.r.p. (dBm)	Part number or model name
1			
2			
3			
4			

Power Level 2: dBm
Number of antenna assemblies provided for this power level:

Assembly #	Gain (dBi)	e.i.r.p. (dBm)	Part number or model name
1			
2			
3			
4			

Power Level 3: dBm
Number of antenna assemblies provided for this power level:

Assembly #	Gain (dBi)	e.i.r.p. (dBm)	Part number or model name
1			
2			
3			
4			

o) The nominal voltages of the stand-alone radio equipment or the nominal voltages of the combined (host) equipment or test jig in case of plug-in devices:
Details provided are for the: ☒stand-alone equipment
☐combined (or host) equipment
☐test jig

Supply Voltage ☐AC mains State AC voltage V
☒DC State DC voltage 5V
In case of DC, indicate the type of power source
☐Internal Power Supply
☐External Power Supply or AC/DC adapter
☐Battery
☒Other: DC 5V from PC

p) Describe the test modes available which can facilitate testing:

q) The equipment type (e.g. Bluetooth®, IEEE 802.11™ [i.3], proprietary, etc.):
IEEE 802.11™ [i.3],Bluetooth®