TESTING LABORATORY
CERTIFICATE NUMBER: 3297.02

Bay Area Compliance Labs Corp.

EN 300 328 V1.9.1 (2015-02)

TEST AND MEASUREMENT REPORT

For

Next Thing Company

1940 Union St #32,

Oakland, CA 94607, USA

Model: HELLA1337

Report Type: Original Report		**Product Type:** C.H.I.P Computer
Prepared By	Jin Yang Test Engineer	
Report Number	R15101413-11 DSS	
Report Date	2015-12-29	
Reviewed By	Bo Li RF Supervisor	
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R15101413-11 DSS	Original Report	2015-12-29

1 General Information

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *Next Thing, Co*., and their product C.H.I. P Computer, model: *HELLA1337* or the "EUT" as referred to in this report. It is a computer, contains 2.4GHz 802.11b/g/n and Bluetooth 4.0 dual modes.

1.2 Mechanical Description of EUT

The EUT measures approximately 60 mm (L) x 41 mm (W) x 10 mm (H) and weighs 23.5 g.

The test data gathered are from typical production sample, serial number: R15101413-01 assigned by BACL.

1.3 Objective

The following type approved report is prepared on behalf *Next Thing, Co..* in accordance with 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 spread spectrum modulation techniques.

The objective is to determine compliance with EN 300 328 V1.9.1 (2015-02), Electromagnetic compatibility and Radio spectrum Matters (ERM) for Bluetooth and WLAN portion.

In order to determine compliance, the manufacturer or a contracted laboratory makes measurements and takes the necessary steps to ensure that the equipment complies with the appropriate technical standards.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product maybe which result in lowering the immunity should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing and/or I/O cable changes, etc.).

1.4 Related Submittal(s)/Grant(s)

No Related Submittals.

1.5 Test Methodology

All measurements contained in this report were conducted with 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 spread spectrum modulation techniques

All tests were performed at Bay Area Compliance Laboratories Corp.

1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the values ranging from ±2.0 dB for Conducted Emissions tests and ±4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL Corp.

1.7 Test Facility

Bay area compliance Laboratories Corp. (BACL) is:
1- An independent Commercial Test Laboratory accredited to **ISO 17025:2005** by **A2LA**, in the fields of: Electromagnetic Compatibility & Telecommunications covering Emissions, Immunity, Radio, RF Exposure, Safety and Telecom. This includes NEBS (Network Equipment Building System), Wireless RF, Telecommunications Terminal Equipment (TTE); Network Equipment; Information Technology Equipment (ITE); Medical Electrical Equipment; Industrial, Commercial, and Medical Test Equipment; Professional Audio and Video Equipment; Electronic (Digital) Products; Industrial and Scientific Instruments; Cabled Distribution Systems and Energy Efficiency Lighting.

2- An ENERGY STAR Recognized Laboratory, for the LM80 Testing, a wide variety of Luminares and Computers.

3- A NIST Designated Phase-I and Phase-II CAB including: ACMA (Australian Communication and Media Authority), BSMI (Bureau of Standards, Metrology and Inspection of Taiwan), IDA (Infocomm Development Authority of Singapore), IC(Industry Canada), Korea (Ministry of Communications Radio Research Laboratory), NCC (Formerly DGT; Directorate General of Telecommunication of Chinese Taipei) OFTA (Office of the Telecommunications Authority of Hong Kong), Vietnam, VCCI - Voluntary Control Council for Interference of Japan and a designated EU CAB (Conformity Assessment Body) (Notified Body) for the EMC and R&TTE Directives.

4- A Product Certification Body accredited to **ISO Guide 65:1996** by **A2LA** to certify:
1- Unlicensed, Licensed radio frequency devices and Telephone Terminal Equipment for the FCC. Scope A1, A2, A3, A4, B1, B2, B3, B4 & C.
2. Radio Standards Specifications (RSS) in the Category I Equipment Standards List and All Broadcasting Technical Standards (BETS) in Category I Equipment Standards List for Industry Canada.
3. Radio Communication Equipment for Singapore.
4. Radio Equipment Specifications, GMDSS Marine Radio Equipment Specifications, and Fixed Network Equipment Specifications for Hong Kong.
5. Japan MIC Telecommunication Business Law (A1, A2) and Radio Law (B1, B2 and B3).
6. Audio/Video, Battery Charging Systems, Computers, Displays, Enterprise Servers, Imaging Equipment, Set-Top Boxes, Telephony, Televisions, Ceiling Fans, CFLs (Including GU24s),Decorative Light Strings, Integral LED Lamps, Luminaires, Residential Ventilating Fans.

The test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at its facility in Sunnyvale, California, USA.

The test site at BACL Corp. has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997, and Article 8 of the VCCI regulations on December 25, 1997. The test site also complies with the test methods and procedures set forth in CISPR 22:2008 §10.4 for measurements below 1 GHz and §10.6 for measurements above 1 GHz as well as ANSI C63.4-2014, ANSI C63.4-2009, TIA/EIA-603 & CISPR 24:2010.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and they are listed under FCC registration number: 90464 and VCCI Registration No.: A-0027. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL Corp. is an American Association for Laboratory Accreditation (A2LA) accredited laboratory (Lab Code 3297-02). The current scope of accreditations can be found at
http://www.a2la.org/scopepdf/3297-02.pdf?CFID=1132286&CFTOKEN=e42a3240dac3f6ba-6DE17DCB-1851-9E57-477422F667031258&jsessionid=8430d44f1f47cf2996124343c704b367816b

2 EUT TEST CONFIGURATION

2.1 Justification

The EUT was configured for testing according to EN 300 328 V1.9.1.

2.2 EUT Exercise Software

The test utility used is *UART Terminal (RS-232)* provided by *Next Thing, Co.*, the software was verified by *Jin Yang* to comply with the standard requirements being tested against.

2.3 Equipment Modifications

A SMA port was attached to the output signal before the antenna of the EUT to perform conducted measurements.

2.4 Local Support Equipment

Manufacturer	Description	Model No.
Acer	Laptop	ZHK

2.5 EUT Internal Configuration Details

Manufacturer	Description	Model
Realtek Semiconductor Corp	WIFI/BT Module	RTL8723BS
Allwinner Technology	Soc	R8

2.6 Support Equipment

Manufacturer	Description	Model
Apple	USB Power Adapter	A1357
Asian Power Devices, Inc	AC Adapter	WB-10E05FU

2.7 Interface Ports and Cabling

Cable Description	Length (m)	To	From
USB Cable	<1M	Laptop	EUT
RF Cable	<1M	EUT	PSA

3 Summary of Test Results

EN 300 328 V1.9.1	Description Of Tests	Results
Section 4.3.1.2	RF Output Power	Compliant
Section 4.3.1.3	Duty Cycle, TX-sequence, TX-gap	N/A[1]
Section 4.3.1.4	Dwell time, Minimum frequency occupation	Compliant
Section 4.3.1.5	Hopping Frequency Separation	Compliant
Section 4.3.1.6	MU factor	N/A[1]
Section 4.3.1.7	Adaptivity	N/A[2]
Section 4.3.1.8	Occupied Channel Bandwidth	Compliant
Section 4.3.1.9	TX Unwanted Emissions in the out-of-band Domain	Compliant
Section 4.3.1.10	TX Unwanted Emissions in the spurious Domain	Compliant
Section 4.3.1.11	Receiver Spurious Emissions	Compliant
Section 4.3.1.12	Receiver Blocking	N/A[2]
Section 4.3.1.13	Geo-location capability	N/A[3]

N/A[1]: EUT is an adaptive device
N/A[2]: The power of EUT is lower than 10 dBm (EIRP)
N/A[3]: This EUT does not have the Geo-location capability

4 EN 300 328 §4.3.1.8 – Occupied Channel Bandwidth

4.1 Applicable Standard

4.3.1.8.1 Applicability

This requirement applies to all types of frequency hopping equipment.

4.3.1.8.2 Definition

The Occupied Channel Bandwidth is the bandwidth that contains 99 % of the power of the signal when considering a single hopping frequency.

4.3.1.8.3 Limits

The Occupied Channel Bandwidth for each hopping frequency 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 supplier. See clause 5.3.1 j). This declared value shall not be greater than 5 MHz.

4.2 Measurement Procedure

Step 1:

Connect the UUT to the spectrum analyser 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 for frequency hopping equipment: Lowest frequency separation that is used within the hopping sequence
- Frequency Span for other types of equipment: 2 × Nominal Channel Bandwidth (e.g. 40 MHz for a 20 MHz channel)
- Detector Mode: RMS
- Trace Mode: Max Hold
- Sweep time: 1 s

Step 2:

Wait for the trace to stabilize.

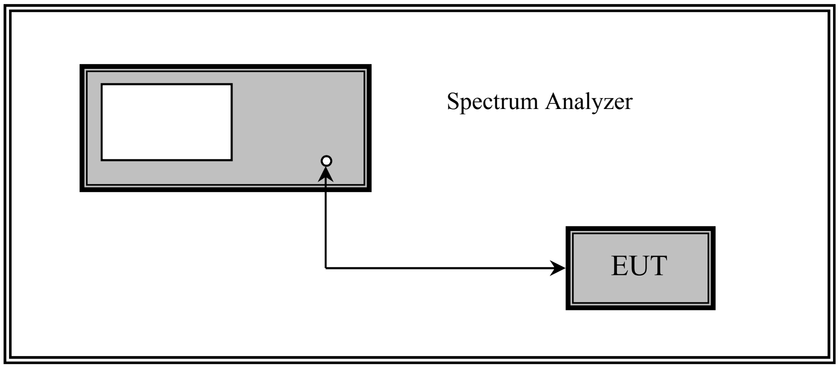
Find the peak value of the trace and place the analyser marker on this peak.

Step 3:

Use the 99 % bandwidth function of the spectrum analyser to measure the Occupied Channel Bandwidth of the UUT. This value shall be recorded.

NOTE: Make sure that the power envelope is sufficiently above the noise floor of the analyser to avoid the noise signals left and right from the power envelope being taken into account by this measurement.

4.3 Test Setup Block Diagram



4.4 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2015-06-22	1 year

***Statement of Traceability*:** BACL Corp. attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

4.5 Environmental Conditions

Temperature:	21 °C
Relative Humidity:	46 %
ATM Pressure:	102kPa

Testing was performed by Jin Yang on 2015-10-23 on RF site.

4.6 Test Results

Bluetooth:

GFSK mode

Channel	Frequency (MHz)	Occupied Channel Bandwidth (MHz)	Limit	Results
Low	2402	0.8949594	2400-2483.5MHz	Pass
Middle	2441	0.8985763	2400-2483.5MHz	Pass
High	2480	0.9003339	2400-2483.5MHz	Pass

Π/4-DQPSK mode

Channel	Frequency (MHz)	Occupied Channel Bandwidth (MHz)	Limit	Results
Low	2402	1.1894	2400-2483.5MHz	Pass
Middle	2441	1.1902	2400-2483.5MHz	Pass
High	2480	1.1910	2400-2483.5MHz	Pass

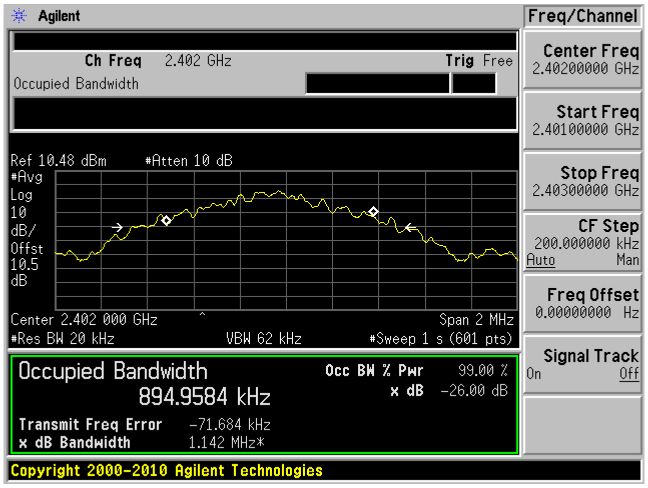
8PSK mode

Channel	Frequency (MHz)	Occupied Channel Bandwidth (MHz)	Limit	Results
Low	2402	1.1797	2400-2483.5MHz	Pass
Middle	2441	1.1807	2400-2483.5MHz	Pass
High	2480	1.1808	2400-2483.5MHz	Pass

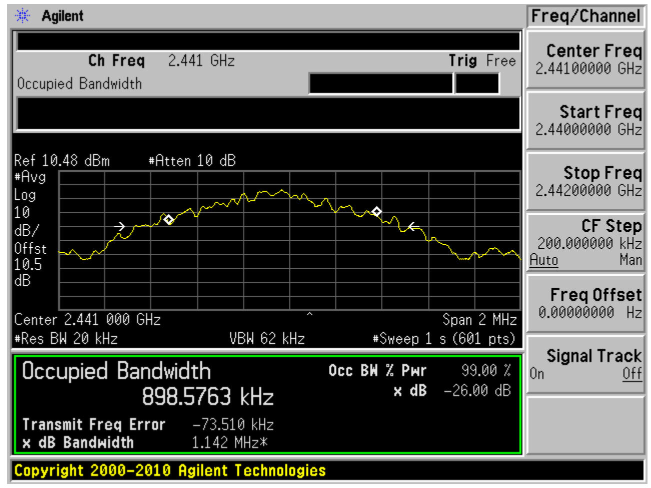
Please refer to the following plots

GFSK

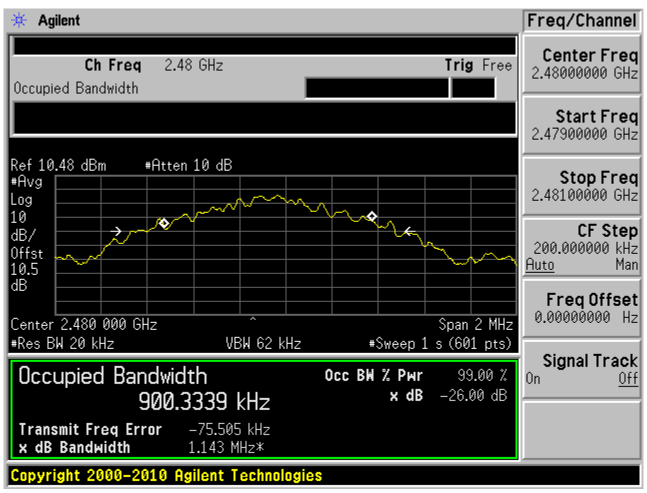
Low Channel 2402 MHz



Middle Channel 2441 MHz

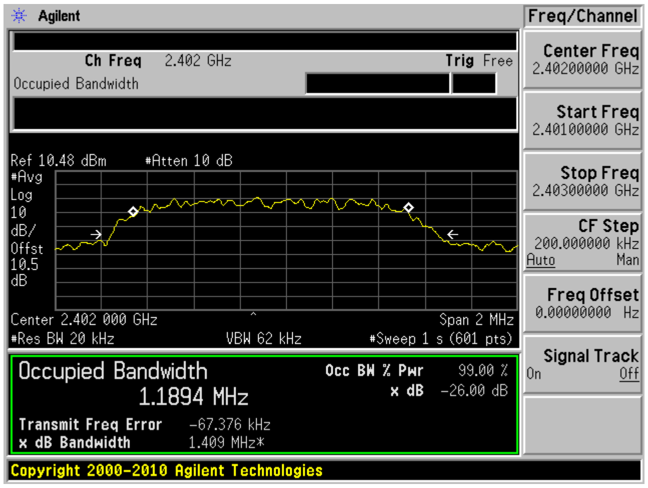


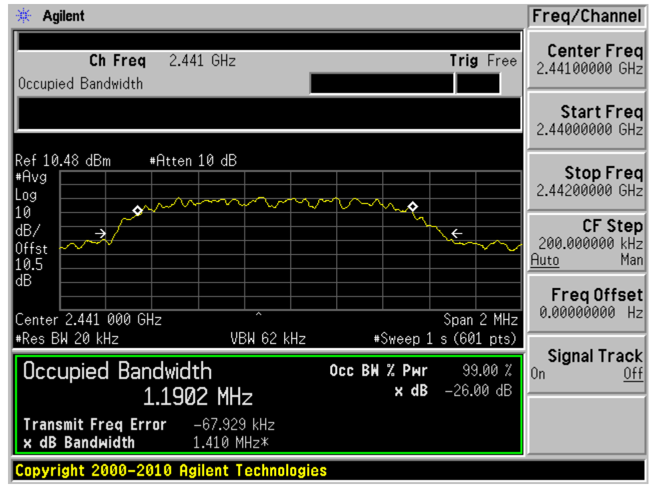
High Channel 2480 MHz



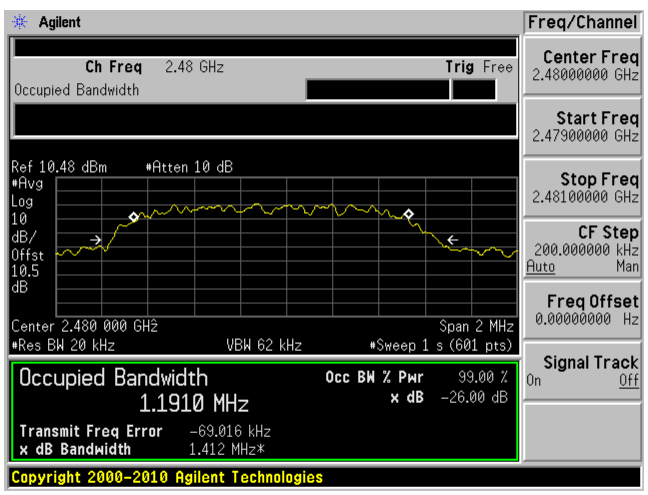
П/4-DQPSK

Low Channel 2402 MHz **Middle Channel 2441 MHz**



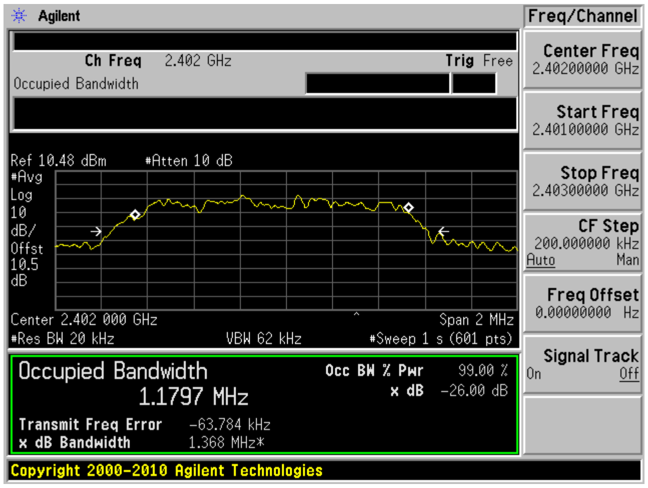


High Channel 2480 MHz

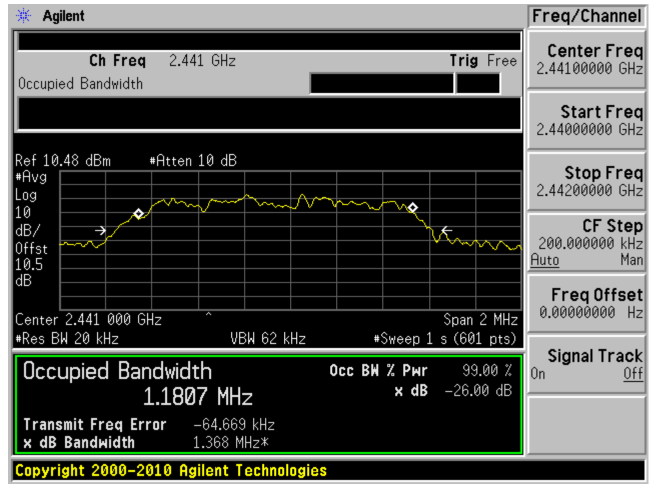


8PSK

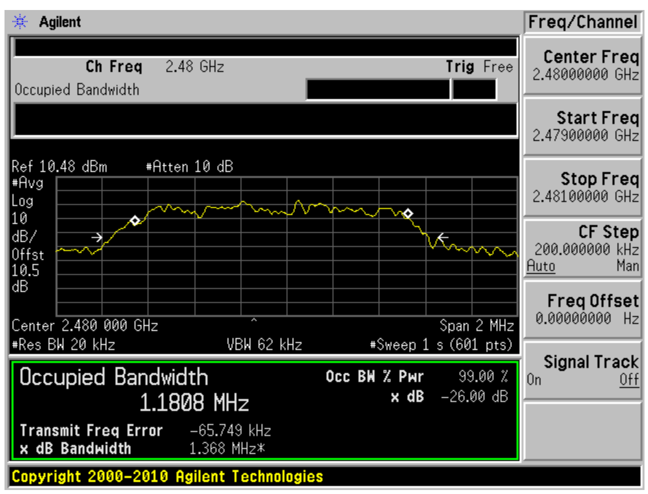
Low Channel 2402 MHz



Middle Channel 2441 MHz



High Channel 2480 MHz



5 EN 300 328 §4.3.1.2 – RF Output Power

5.1 Applicable Standard

4.3.1.2.2 Definition

The RF output power is defined as the mean equivalent isotropically radiated power (e.i.r.p.) of the equipment during a transmission burst.

4.3.1.2.3 Limit

The maximum RF output power for adaptive Frequency Hopping equipment shall be equal to or less than 20 dBm.

The maximum RF output power for non-adaptive Frequency Hopping equipment shall be declared by the supplier. See clause 5.3.1 m). The maximum RF output power for this equipment shall be equal to or less than the value declared by the supplier. This declared value shall be equal to or less than 20 dBm.

This limit shall apply for any combination of power level and intended antenna assembly.

5.2 Measurement 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 transmit 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.

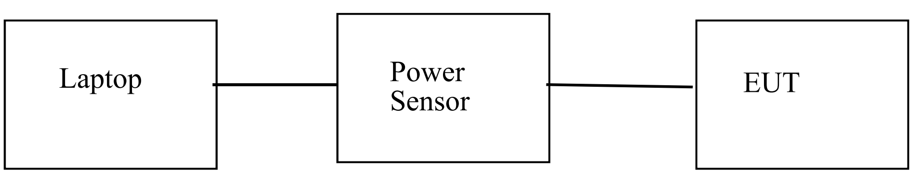
Step 6:

- Add the (stated) antenna assembly gain "G" in dBi of the individual antenna.
- If applicable, add the additional beamforming gain "Y" in dB.
- If more than one antenna assembly is intended for this power setting, the maximum overall antenna gain (G or G + Y) shall be used.
- The RF Output Power (P) shall be calculated using the formula below:

$$P = A + G + Y$$

- This value, which shall comply with the limit given in clause 4.3.1.2.3 or clause 4.3.2.2.3, shall be recorded in the test report.

5.3 Test Setup Block Diagram



5.4 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
ETS- Lindgren	Power Sensor	7002-006	160097	2014-10-21	2 year

***Statement of Traceability*:** BACL Corp. attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

5.5 Environmental Conditions

Temperature:	21 °C
Relative Humidity:	46 %
ATM Pressure:	102kPa

Testing was performed by Jin Yang on 2015-10-23 on RF site.

5.6 Test Results

DH1

Frequency (MHz)	GFSK Power (dBm)	GFSK e.i.r.p (dBm)	Π/4-DQPSK Power (dBm)	Π/4-DQPSK e.i.r.p. (dBm)	8PSK Power (dBm)	8PSK e.i.r.p. (dBm)	Limit (dBm)
2402	5.75	8.25	5.03	7.53	5.01	7.51	20
2441	5.96	8.46	5.31	7.81	5.14	7.64	20
2480	5.88	8.38	5.12	7.62	5.17	7.67	20

DH3

Frequency (MHz)	GFSK Power (dBm)	GFSK e.i.r.p (dBm)	Π/4-DQPSK Power (dBm)	Π/4-DQPSK e.i.r.p. (dBm)	8PSK Power (dBm)	8PSK e.i.r.p. (dBm)	Limit (dBm)
2402	5.72	8.22	4.92	7.42	4.99	7.49	20
2441	5.89	8.39	5.12	7.62	5.08	7.58	20
2480	5.87	8.37	5.08	7.58	5.16	7.66	20

DH5

Frequency (MHz)	GFSK Power (dBm)	GFSK e.i.r.p (dBm)	Π/4-DQPSK Power (dBm)	Π/4-DQPSK e.i.r.p. (dBm)	8PSK Power (dBm)	8PSK e.i.r.p. (dBm)	Limit (dBm)
2402	5.51	8.01	4.83	7.33	5.02	7.52	20
2441	5.73	8.23	4.88	7.38	5.16	7.66	20
2480	5.78	8.28	4.98	7.48	4.97	7.47	20

Note: the antenna gain at 2.4GHz is 2.5dBi.

6 EN 300 328 §4.3.1.4 Dwell time, Minimum Frequency Occupation and Hopping Sequence

6.1 Applicable Standard

4.3.1.4.2 Definition

The Accumulated Transmit Time is the total of the transmitter 'on' times, during an observation period, on a particular hopping frequency.

The Frequency Occupation is the number of times that each hopping frequency is occupied within a given period. A hopping frequency is considered to be occupied when the equipment selects that frequency from the hopping sequence. The equipment may be transmitting, receiving or stay idle during the Dwell Time spent on that hopping frequency.

The Hopping Sequence of a frequency hopping equipment is the unrepeated pattern of the hopping frequencies used by the equipment.

4.3.1.4.3 Limit

4.3.1.4.3.2 Adaptive frequency hopping equipment

Adaptive Frequency Hopping equipment shall be capable of operating over a minimum of 70 % of the band specified in clause 1.

The Accumulated Transmit Time on any hopping frequency shall not be greater than 400 ms within any observation period of 400 ms multiplied by the minimum number of hopping frequencies (N) that have to be used.

In order for the equipment to comply with the Frequency Occupation requirement, it shall meet either of the following two options:

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.

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.

6.2 Measurement Procedures

Step 1:

- The output of the transmitter shall be connected to a spectrum analyzer or equivalent.
- 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:	Equal to the applicable observation period (see clause 4.3.1.4.3.1 or clause 4.3.1.4.3.2)
- Number of sweep points:	30 000
- Trace mode:	Clear / Write
- Trigger:	Free Run

Step 2:

- Save the trace data to a file for further analysis by a computing device using an appropriate software application or program.

Step 3:

- Identify the data points related to the frequency being investigated by applying a threshold.

  The data points resulting from transmissions on the hopping frequency being investigated are assumed to have much higher levels compared to data points resulting from transmissions on adjacent hopping frequencies. If a clear determination between these transmissions is not possible, the RBW in step 1 shall be further reduced. In addition, a channel filter may be used.

- 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.

Step 4:

- The result in step 3 is the Accumulated Transmit Time which shall comply with the limit provided in clause 4.3.1.4.3.1 or clause 4.3.1.4.3.2 and which shall be recorded in the test report.

Step 5:

NOTE 1: This step is only applicable for equipment implementing Option 1 in clause 4.3.1.4.3.1 or clause 4.3.1.4.3.2 for complying with the Frequency Occupation requirement and the manufacturer decides to demonstrate compliance with this requirement via measurement.

- Make the following changes on the analyser and repeat step 2 and step 3.

  Sweep time: 4 × Dwell Time × Actual number of hopping frequencies in use

  The hopping frequencies occupied by the equipment without having transmissions during the dwell time (blacklisted frequencies) should be taken into account in the actual number of hopping frequencies in use. If this number cannot be determined (number of blacklisted frequencies unknown) it shall be assumed that the equipment uses the maximum possible number of hopping frequencies.

- The result shall be compared to the limit for the Frequency Occupation defined in clause 4.3.1.4.3.1 or clause 4.3.1.4.3.2. The result of this comparison shall be recorded in the test report.

Step 6:

- Make the following changes on the analyzer:
  - Start Frequency: 2 400 MHz
  - Stop Frequency: 2 483,5 MHz
  - RBW: ~ 50 % of the Occupied Channel Bandwidth (single hopping frequency)
  - VBW: ≥ RBW
  - Detector Mode: RMS
  - Sweep time: 1 s
  - Trace Mode: Max Hold
  - Trigger: Free Run

NOTE 2: The above sweep time setting may result in long measuring times. To avoid such long measuring times, an FFT analyser could be used.

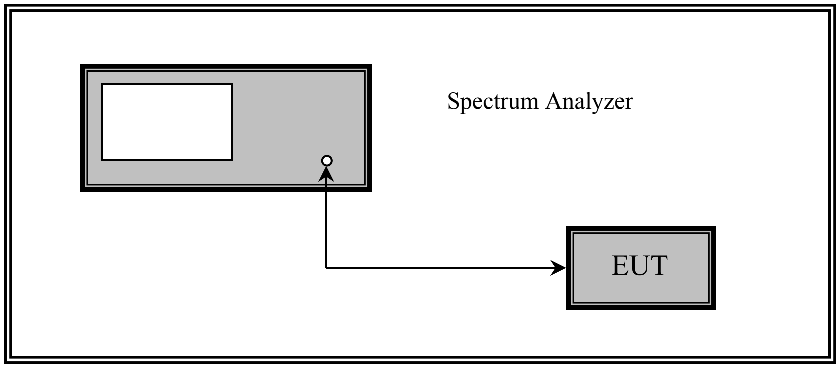
- Wait for the trace to stabilize. Identify the number of hopping frequencies used by the hopping sequence.
- The result shall be compared to the limit (value N) defined in clause 4.3.1.4.3.1 or clause 4.3.1.4.3.2. This value shall be recorded in the test report.

  For equipment with blacklisted frequencies, it might not be possible to verify the number of hopping frequencies in use. However they shall comply with the requirement for Accumulated Transmit Time and Frequency Occupation assuming the minimum number of hopping frequencies (N) defined in clause 4.3.1.4.3.1 or clause 4.3.1.4.3.2 is used.

Step 7:

- For adaptive equipment, using the lowest and highest -20 dB points from the total spectrum envelope obtained in step 6, it shall be verified whether the equipment uses 70 % of the band specified in clause 1. The result shall be recorded in the test report.

Test Setup Block Diagram



6.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2015-06-22	1 year

***Statement of Traceability*: ** BACL Corp. attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

6.4 Environmental Conditions

Temperature:	21 °C
Relative Humidity:	46 %
ATM Pressure:	102kPa

Testing was performed by Jin Yang on 2015-10-23 on RF site.

6.5 Test Results

Channel	Pulse Width (ms)	Dwell time (sec)	Limit (sec)	Results
1-DH1				
Low	0.410	0.13	0.4	Pass
Mid	0.4117	0.13	0.4	Pass
High	0.4117	0.13	0.4	Pass
2-DH1				
Low	0.420	0.13	0.4	Pass
Mid	0.420	0.13	0.4	Pass
High	0.420	0.13	0.4	Pass
3-DH1				
Low	0.420	0.13	0.4	Pass
Mid	0.420	0.13	0.4	Pass
High	0.420	0.13	0.4	Pass
1-DH3				
Low	1.675	0.27	0.4	Pass
Mid	1.675	0.27	0.4	Pass
High	1.680	0.27	0.4	Pass
2-DH3				
Low	1.685	0.27	0.4	Pass
Mid	1.685	0.27	0.4	Pass
High	1.685	0.27	0.4	Pass
3-DH3				
Low	1.685	0.27	0.4	Pass
Mid	1.685	0.27	0.4	Pass
High	1.685	0.27	0.4	Pass
1-DH5				
Low	2.925	0.31	0.4	Pass
Mid	2.925	0.31	0.4	Pass
High	2.925	0.31	0.4	Pass
2-DH5				
Low	2.933	0.31	0.4	Pass
Mid	2.933	0.31	0.4	Pass
High	2.933	0.31	0.4	Pass
3-DH5				
Low	2.933	0.31	0.4	Pass
Mid	2.933	0.31	0.4	Pass
High	2.933	0.31	0.4	Pass

Note: DH1: Dwell time = Pulse time*(1600/2/79)*31.6S
DH3: Dwell time = Pulse time*(1600/4/79)*31.6S
DH5: Dwell time = Pulse time*(1600/6/79)*31.6S

7 EN 300 328 § 4.3.1.5 Hopping Frequency Separation

7.1 Applicable Standard

4.3.1.5.2 Definition

The Hopping Frequency Separation is the frequency separation between two adjacent hopping frequencies.

4.3.1.5.3 Limit

4.3.1.5.3.2 Adaptive frequency hopping equipment

For adaptive Frequency Hopping equipment, the minimum Hopping Frequency Separation shall be 100 kHz.

Adaptive Frequency Hopping equipment, which for one or more hopping frequencies, has switched to a non-adaptive mode because interference was detected on all these hopping positions with a level above the threshold level defined in clause 4.3.1.7.2.2 or clause 4.3.1.7.3.2, is allowed to continue to operate with a minimum Hopping Frequency Separation of 100 kHz on these hopping frequencies as long as the interference is present on these frequencies. The equipment shall continue to operate in an adaptive mode on other hopping frequencies.

Adaptive Frequency Hopping equipment which decided to operate in a non-adaptive mode on one or more hopping frequencies without the presence of interference, shall comply with the limit in clause 4.3.1.5.3.1 for these hopping frequencies as well as with all other requirements applicable to non-adaptive frequency hopping equipment.

7.2 Measurement Procedures

Step 1:

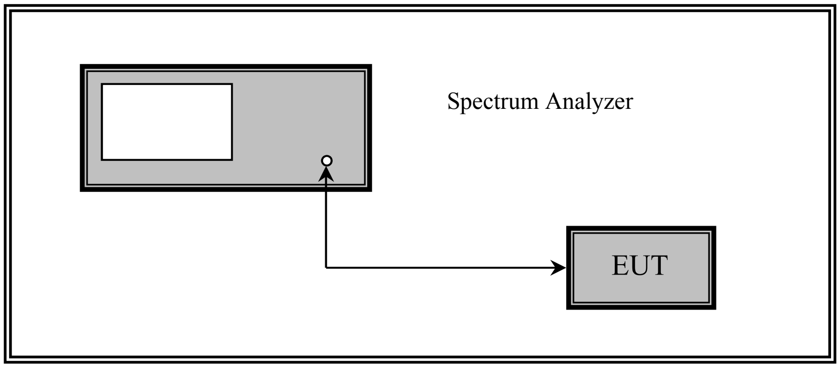
- The output of the transmitter shall be connected to a spectrum analyser or equivalent.
- The analyser shall be set as follows:
  - Centre Frequency: Centre of the two adjacent hopping frequencies
  - Frequency Span: Sufficient to see the complete power envelope of both hopping frequencies
  - RBW: 1 % of the span
  - VBW: 3 × RBW
  - Detector Mode: RMS
  - Trace Mode: Max Hold
  - Sweep Time: 1 s

NOTE: Depending on the nature of the signal (modulation), it might be required to use a much longer sweep time, e.g. in case switching transients are present in the signals to be investigated.

Step 2:

- 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). This value shall be compared with the limits defined in clause 4.3.1.5.3 and shall be recorded in the test report.

7.3 Test Setup Block Diagram



7.4 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2015-06-22	1 year

***Statement of Traceability*: ** BACL Corp. attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

7.5 Environmental Conditions

Temperature:	21 °C
Relative Humidity:	46 %
ATM Pressure:	102kPa

Testing was performed by Jin Yang on 2015-10-23 on RF site.

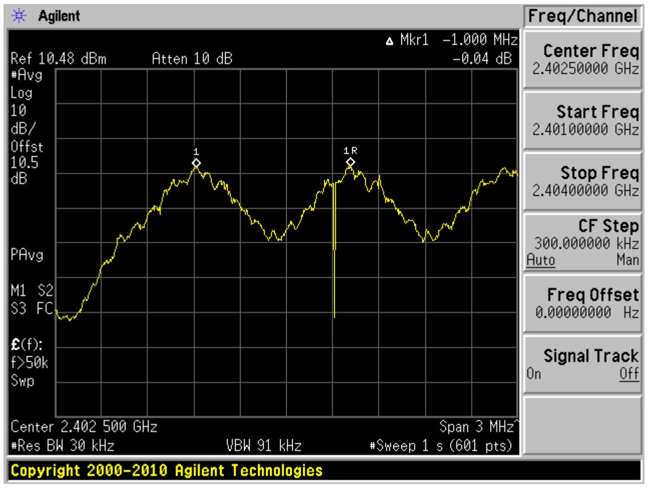
7.6 Test Result

Mode	Channel	Channel Separation (MHz)	Limit (kHz)
GFSK	Low	1.000	>100
	Middle	0.990	>100
	High	1.015	>100
Π/4-DQPSK	Low	0.995	>100
	Middle	1.010	>100
	High	0.990	>100
8PSK	Low	0.990	>100
	Middle	1.005	>100
	High	1.000	>100

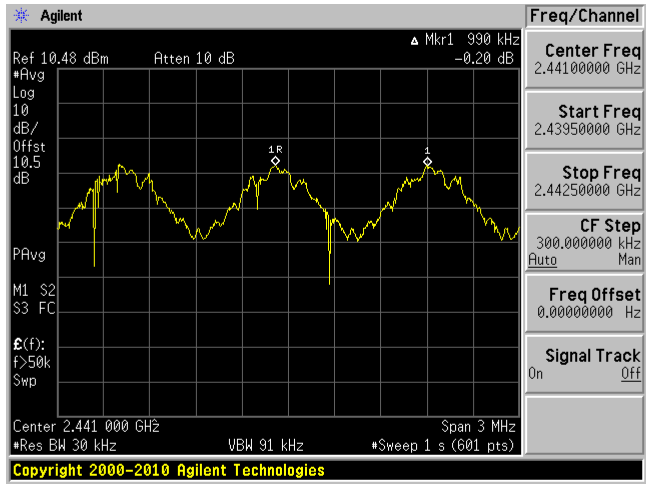
Please refer to the following plots.

GFSK

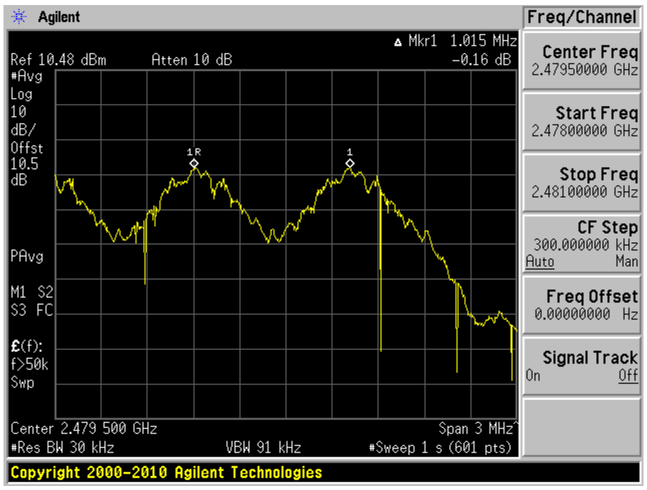
Low Channel 2402 MHz



Middle Channel 2441 MHz

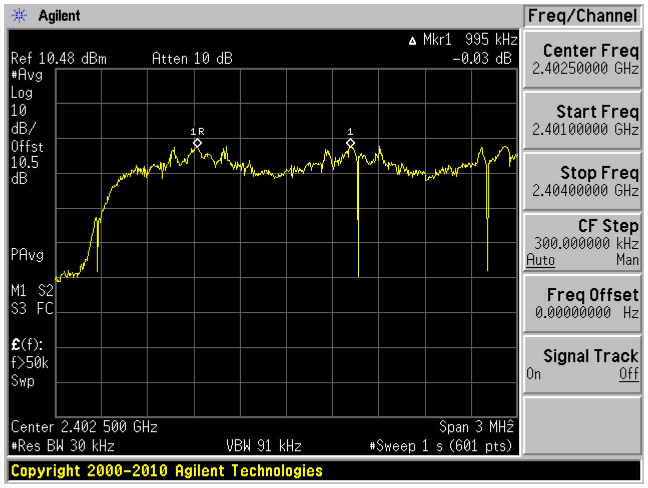


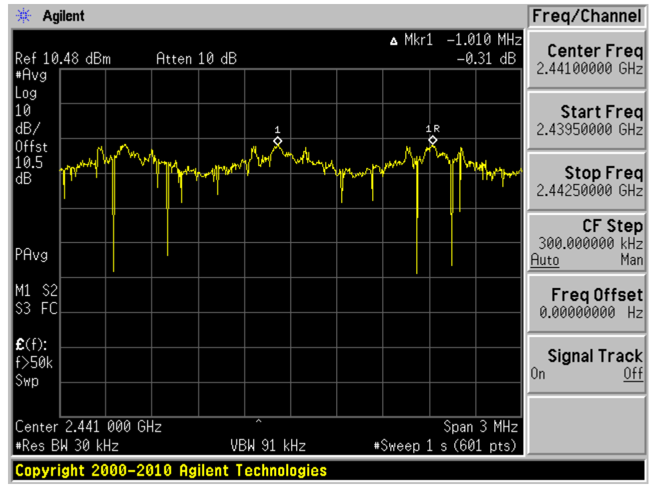
High Channel 2480 MHz



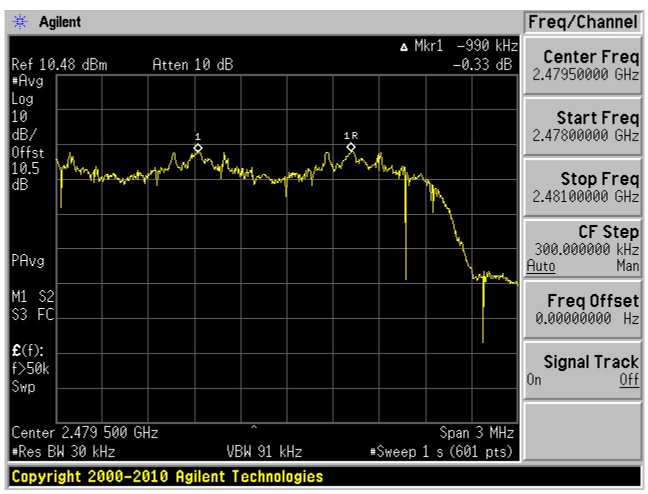
Π/4-DQPSK

Low Channel 2402 MHz **Middle Channel 2441 MHz**



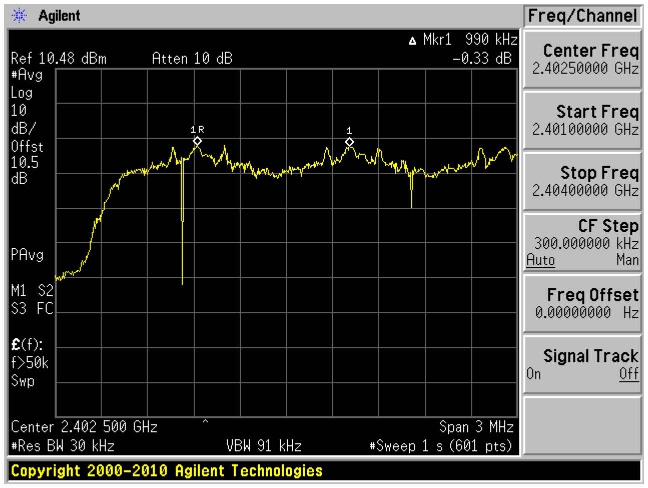


High Channel 2480 MHz

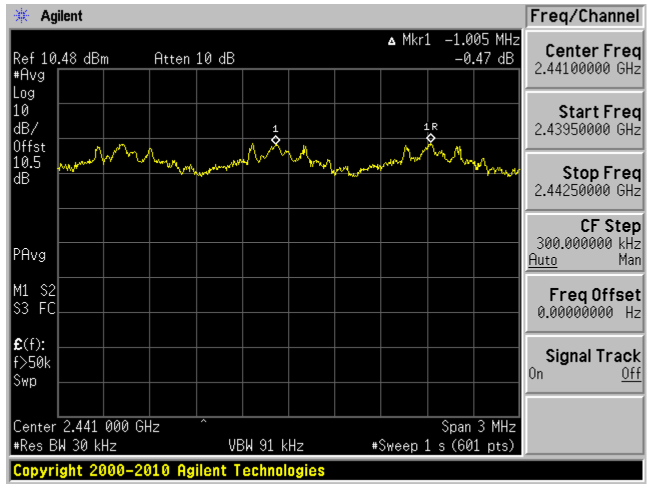


8PSK

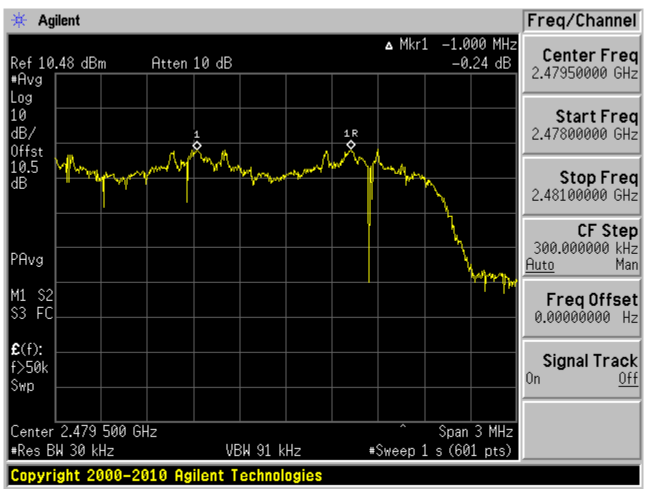
Low Channel 2402 MHz



Middle Channel 2441 MHz



High Channel 2480 MHz



8 EN 300 328 §4.3.1.9 – TX Unwanted Emissions in the out of Band Domain

8.1 Applicable Standard

According to EN 300 328 V1.9.1, §4.3.1.9

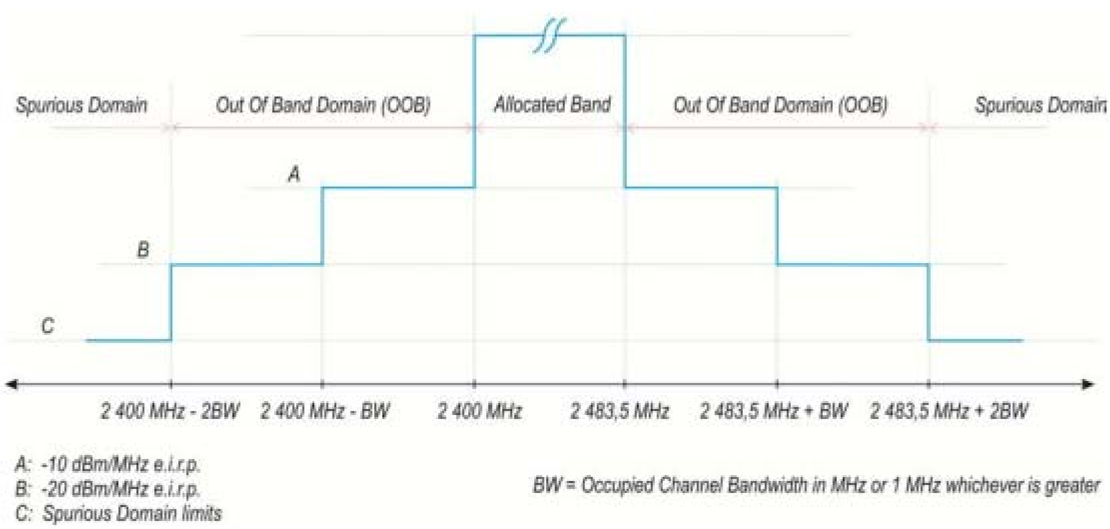
4.3.1.9.2 Definition

Transmitter unwanted emissions in the out-of-band domain are emissions when the equipment is in Transmit mode, on frequencies immediately outside the necessary bandwidth which results from the modulation process, but excluding spurious emissions.

4.3.1.9.3 Limit

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.

NOTE: Within the 2 400 MHz to 2 483,5 MHz band, the Out-of-band emissions are fulfilled by compliance with the Occupied Channel Bandwidth requirement in clause 4.3.1.8.



8.2 Measurement Procedure

Step 1:

- Connect the UUT to the spectrum analyser and use the following settings:
  - Centre Frequency: 2 484 MHz
  - Span: 0 Hz
  - Resolution BW: 1 MHz
  - Filter mode: Channel filter
  - Video BW: 3 MHz
  - Detector Mode: RMS
  - Trace Mode: Max Hold
  - Sweep Mode: Continuous
  - Sweep Points: Sweep Time [s] / (1 μs) or 5 000 whichever is greater
  - Trigger Mode: Video trigger

NOTE 1: In case video triggering is not possible, an external trigger source may be used.

  - Sweep Time: > 120 % of the duration of the longest burst detected during the measurement of the RF Output Power

Step 2 (segment 2 483,5 MHz to 2 483,5 MHz + BW):

- Adjust the trigger level to select the transmissions with the highest power level.
- For frequency hopping equipment operating in a normal hopping mode, the different hops will result in signal bursts with different power levels. In this case the burst with the highest power level shall be selected.
- Set a window (start and stop lines) to match with the start and end of the burst and in which the RMS power shall be measured using the Time Domain Power function.
- Select RMS power to be measured within the selected window and note the result which is the RMS power within this 1 MHz segment (2 483,5 MHz to 2 484,5 MHz). Compare this value with the applicable limit provided by the mask.
- Increase the centre frequency in steps of 1 MHz and repeat this measurement for every 1 MHz segment within the range 2 483,5 MHz to 2 483,5 MHz + BW. The centre frequency of the last 1 MHz segment shall be set to 2 483,5 MHz + BW - 0,5 MHz (which means this may partly overlap with the previous 1 MHz segment).

Step 3 (segment 2 483,5 MHz + BW to 2 483,5 MHz + 2BW):

- Change the centre frequency of the analyser to 2 484 MHz + BW and perform the measurement for the first 1 MHz segment within range 2 483,5 MHz + BW to 2 483,5 MHz + 2BW. Increase the centre frequency in 1 MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2 483,5 MHz + 2 BW - 0,5 MHz (which means this may partly overlap with the previous 1 MHz segment).

Step 4 (segment 2 400 MHz - BW to 2 400 MHz):

- Change the centre frequency of the analyser to 2 399,5 MHz and perform the measurement for the first 1 MHz segment within range 2 400 MHz - BW to 2 400 MHz Reduce the centre frequency in 1 MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2 400 MHz - BW + 0,5 MHz (which means this may partly overlap with the previous 1 MHz segment).

Step 5 (segment 2 400 MHz - 2BW to 2 400 MHz - BW):

- Change the centre frequency of the analyser to 2 399,5 MHz - BW and perform the measurement for the first 1 MHz segment within range 2 400 MHz - 2BW to 2 400 MHz - BW. Reduce the centre frequency in 1 MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2 400 MHz - 2BW + 0,5 MHz (which means this may partly overlap with the previous 1 MHz segment).

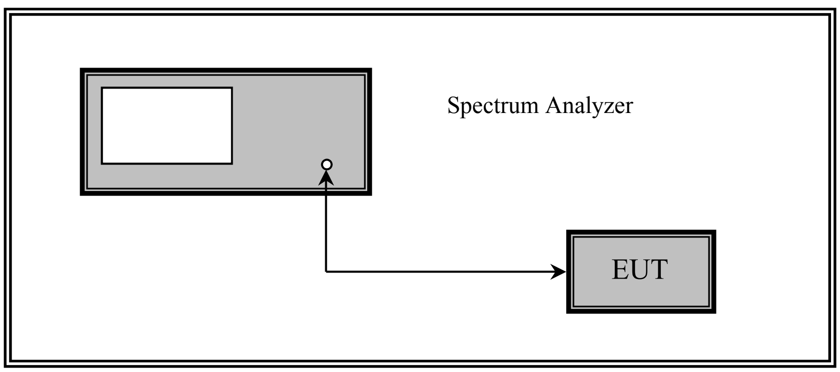
Step 6:

- In case of conducted measurements on equipment with a single transmit chain, the declared antenna assembly gain "G" in dBi shall be added to the results for each of the 1 MHz segments and compared with the limits provided by the mask given in figure 1 or figure 3. If more than one antenna assembly is intended for this power setting, the antenna with the highest gain shall be considered.
- In case of conducted measurements on smart antenna systems (equipment with multiple transmit chains), the measurements need to be repeated for each of the active transmit chains. The declared antenna assembly gain "G" in dBi for a single antenna shall be added to these results. If more than one antenna assembly is intended for this power setting, the antenna with the highest gain shall be considered. Comparison with the applicable limits shall be done using any of the options given below:
  - Option 1: the results for each of the transmit chains for the corresponding 1 MHz segments shall be added. The additional beamforming gain "Y" in dB shall be added as well and the resulting values compared with the limits provided by the mask given in figure 1 or figure 3.
  - Option 2: the limits provided by the mask given in figure 1 or figure 3 shall be reduced by $10 \times \log_{10}(A_{ch})$ and the additional beamforming gain "Y" in dB. The results for each of the transmit chains shall be individually compared with these reduced limits.

NOTE 2: A_{ch} refers to the number of active transmit chains.

It shall be recorded whether the equipment complies with the mask provided in figure 1 or figure 3.

8.3 Test Setup Block Diagram



8.4 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2015-06-22	1 year

Statement of Traceability: BACL attests that all calibrations have been performed per the A2LA requirements, traceable to NIST.

8.5 Environmental Conditions

Temperature:	21 °C
Relative Humidity:	46 %
ATM Pressure:	102kPa

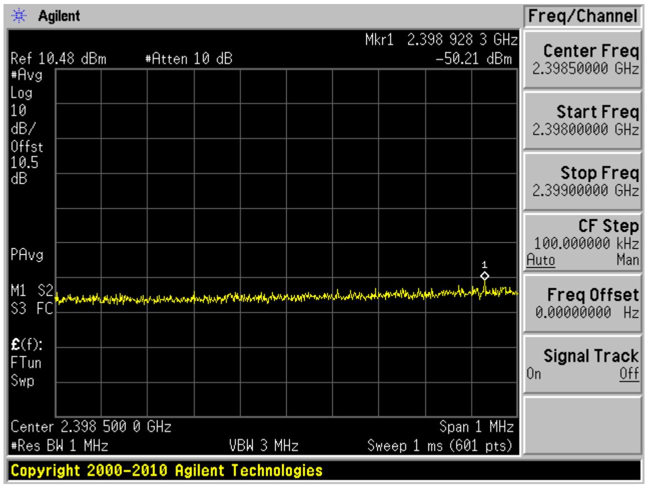
Testing was performed by Jin Yang on 2015-10-23 on RF site.

8.6 Test Results

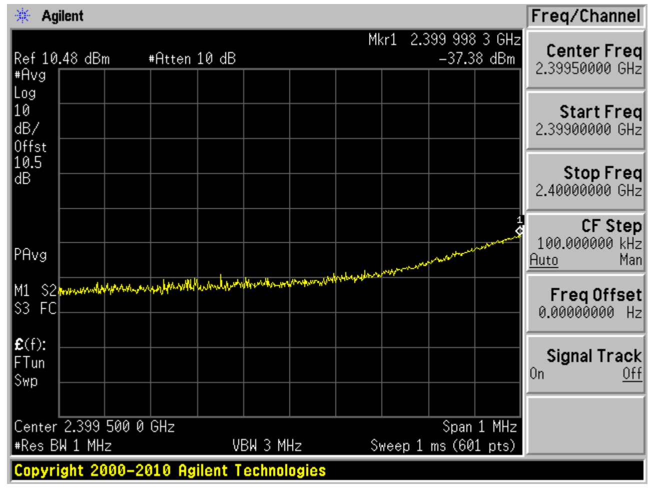
Channel	Frequency (MHz)	S.A Amp. (dBm/MHz)	Antenna Gain (dBi)	Limit e.i.r.p (dBm/MHz)	Results
GFSK					
0	2398-2399	-50.21	2.5	-20	Pass
0	2399-2400	-37.38	2.5	-10	Pass
78	2483.5-2484.5	-52.10	2.5	-10	Pass
78	2484.5-2485.5	-52.61	2.5	-20	Pass
Π/4-DQPSK					
0	2398-2399	-45.16	2.5	-20	Pass
0	2399-2400	-24.15	2.5	-10	Pass
78	2483.5-2484.5	-51.09	2.5	-10	Pass
78	2484.5-2485.5	-53.79	2.5	-20	Pass
8PSK					
0	2398-2399	-44.76	2.5	-20	Pass
0	2399-2400	-23.54	2.5	-10	Pass
78	2483.5-2484.5	-49.90	2.5	-10	Pass
78	2484.5-2485.5	-52.93	2.5	-20	Pass

GFSK

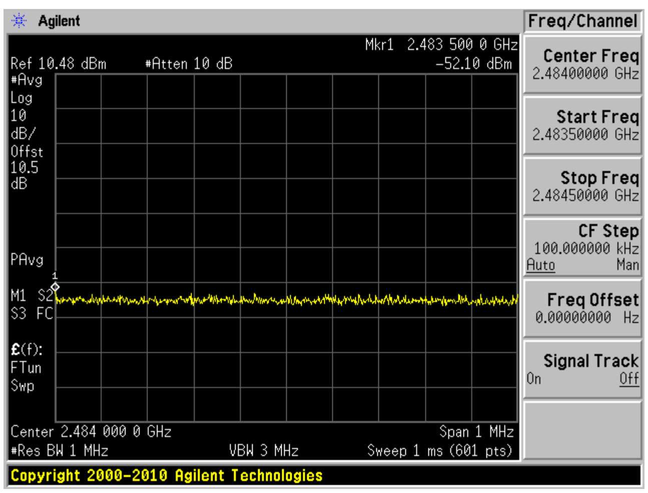
2398 MHz – 2399 MHz



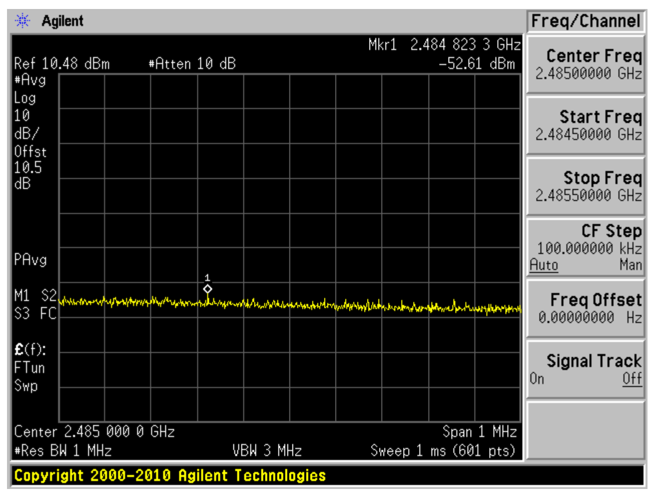
2399 MHz – 2400 MHz



2483.5 MHz – 2484.5 MHz

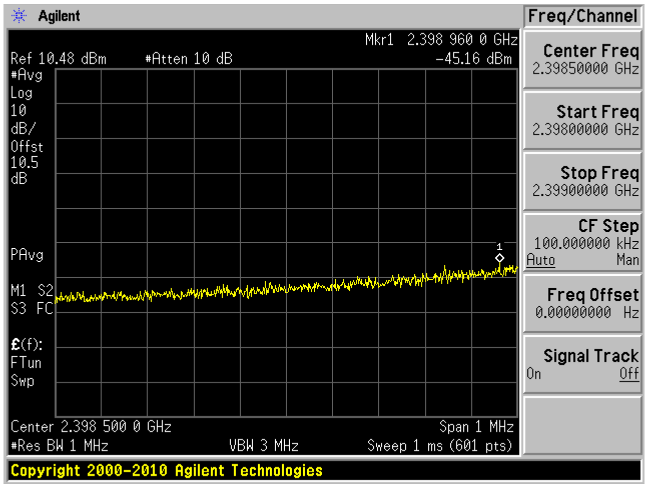


2484.5 MHz – 2485.5 MHz

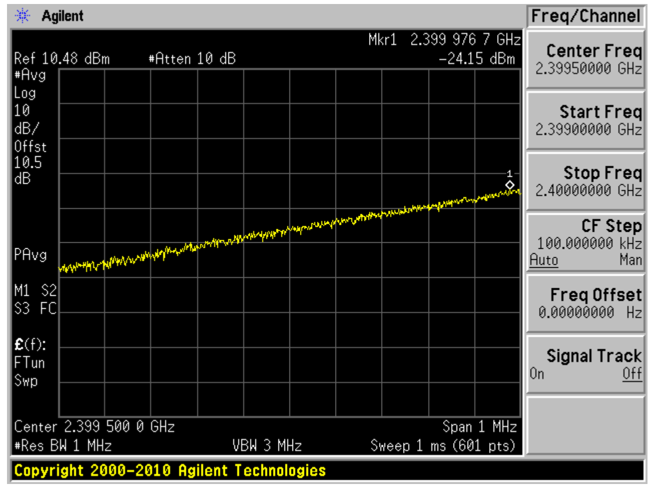


Π/4-DQPSK

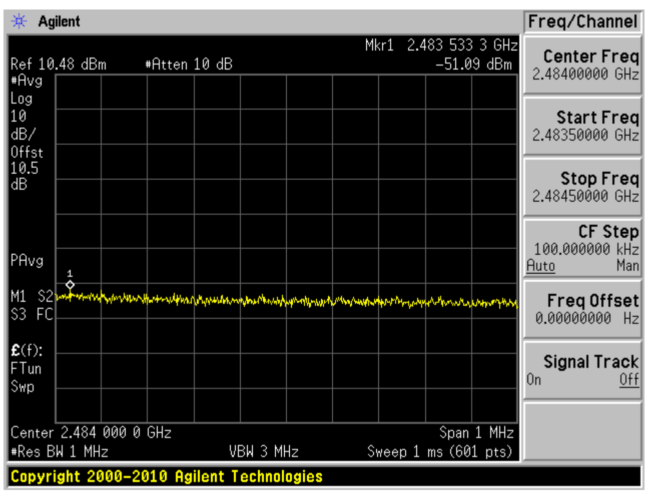
2398 MHz – 2399 MHz



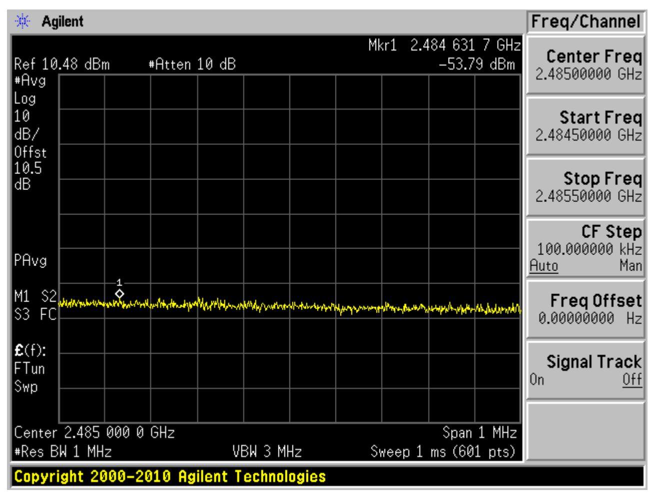
2399 MHz – 2400 MHz



2483.5 MHz – 2484.5 MHz

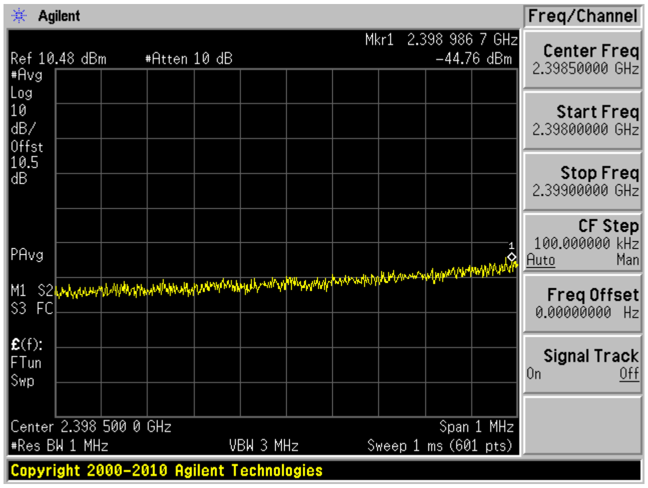


2484.5 MHz – 2485.5 MHz

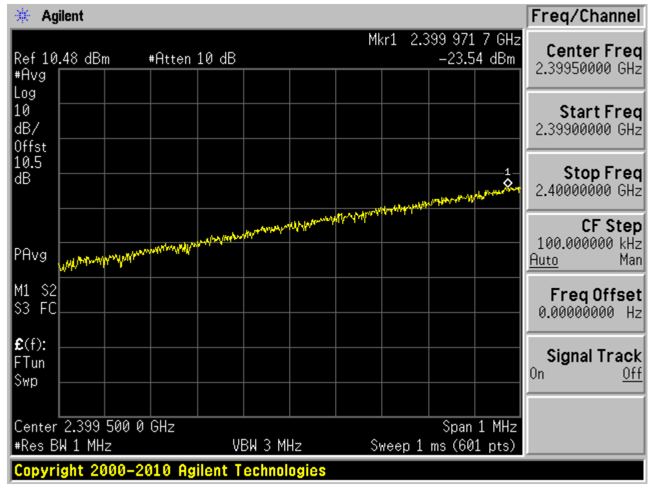


8PSK

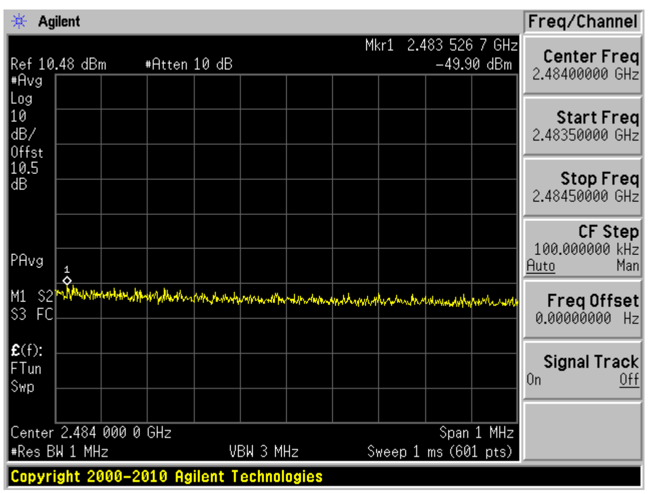
2398 MHz – 2399 MHz



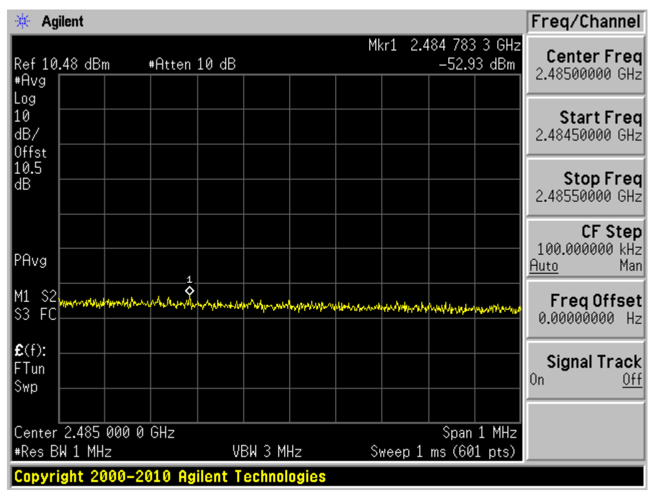
2399 MHz – 2400 MHz



2483.5 MHz – 2484.5 MHz



2484.5 MHz – 2485.5 MHz



9 EN 300 328 §4.3.1.10 – TX Unwanted emissions in the Spurious Domain

9.1 Applicable Standard

Table 1: Transmitter limits for spurious emissions

Frequency range	Maximum power	Bandwidth
30 MHz to 47 MHz	-36 dBm	100 kHz
47 MHz to 74 MHz	-54 dBm	100 kHz
74 MHz 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

9.2 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at BACL is ±4.0 dB.

9.3 EUT Setup

The radiated emissions tests were performed in a shield room, using the setup accordance with the EN 300 328 V1.9.1. The specification used was the EN 300 328 V1.9.1 limits.

External I/O cables were draped along the edge of the test table and bundle when necessary.

9.4 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2015-06-22	1 year
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
Sunol Science Corp	Combination Antenna	JB3	A020106-3	2015-07-11	1 year
Hewlett Packard	Pre-amplifier	8447D	2944A10187	2015-03-20	1 year
HP/ Agilant	Pre Amplifier	8449B OPT HO2	3008A0113	2015-03-11	1year
Sunol	Horn antenna	DRH-118	A052704	2015-03-09	1 year
EMCO	Antenna, Horn	3115	9511-4627	2015-01-15	1 year
HP	Signal Generator	83650B	18485-91	2015-08-19	1 year
COM-POWER	Antenna, Dipole	AD-100	721033DB1, 721033DB2, 721033DB3, 721033DB4,	2014-11-03	2 year

Statement of Traceability: BACL attests that all calibrations have been performed per the A2LA requirements, traceable to NIST.

9.5 Environmental Conditions

Temperature:	24-26º C
Relative Humidity:	45-48 %
ATM Pressure:	101-102 kPa

Testing was performed by Jin Yang on 2015-10-28 at RF site and 5M3 chamber.

9.6 Measurement Procedure

For the radiated emissions test, the EUT and all support equipment power cords were connected to the AC floor outlet since the power supply used in the EUT did not provide an accessory power outlet.

Maximization procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations. All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dBµV of specification limits), and are distinguished with a "**QP**" in the data table.

9.7 Summary of Test Results

According to the data in following tables, the EUT complied with the EN 300 328 V1.9.1 standards and had the worst margin of:

BT: -1.42dB at **550 MHz** in **the Vertical** polarization, High Channel

For detailed results please refer to the following tables and plots

Radiated Spurious Emission (30 MHz – 12.75 GHz)

After pre-scan, the Bluetooth worst Mode: GFSK

GFSK Low Channel 2402 MHz:

Freq. (MHz)	S.A. Amp. (dBμV)	Table Azimuth (Degrees)	Test Antenna		Substitution				Absolute Level (dBm)	EN 300 328	
			Height (cm)	Polar (H/V)	Freq. (MHz)	S.G. Level (dBm)	Antenna Gain (dBi)	Cable Loss (dB)		Limit (dBm)	Margin (dB)
4804	43.26	0	100	H	4804	-57.06	10.978	1.39	-47.472	-30	-17.472
4804	43.22	0	100	V	4804	-56.57	11.017	1.39	-46.943	-30	-16.943
7206	43.5	0	100	H	7206	-49.95	11.539	1.81	-40.221	-30	-10.221
7206	42.32	0	100	V	7206	-50.94	11.51	1.81	-41.24	-30	-11.24
550	39.89	223	143	H	550	-55.58	0	0.5	-56.08	-54	-2.08
550	39.21	256	137	V	550	-55.58	0	0.5	-56.08	-54	-2.08
750	29.12	177	132	H	750	-63.61	0	0.54	-64.15	-54	-10.15
650	25.98	224	121	V	650	-66.84	0	0.58	-67.42	-54	-13.42
450	36.02	166	130	H	450	-61.43	0	0.4	-61.83	-36	-25.83
450	32.79	218	100	V	450	-63.62	0	0.4	-64.02	-36	-28.02

GFSK High Channel 2480 MHz:

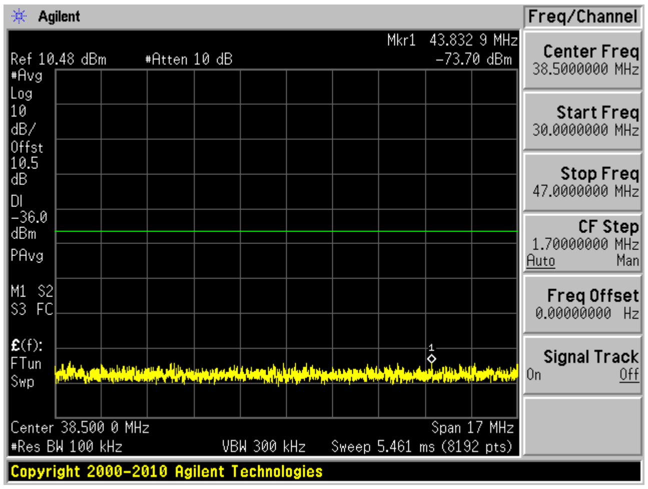
Freq. (MHz)	S.A. Amp. (dBμV)	Table Azimuth (Degrees)	Test Antenna		Substitution				Absolute Level (dBm)	EN 300 328	
			Height (cm)	Polar (H/V)	Freq. (MHz)	S.G. Level (dBm)	Antenna Gain (dBi)	Cable Loss (dB)		Limit (dBm)	Margin (dB)
4960	43.77	0	100	H	4960	-55.4	10.917	1.37	-45.853	-30	-15.853
4960	43.23	0	100	V	4960	-55.13	10.931	1.37	-45.569	-30	-15.569
7440	43.21	0	100	H	7440	-49.94	11.137	1.85	-40.653	-30	-10.653
7440	43.02	0	100	V	7440	-50.16	11.136	1.85	-40.874	-30	-10.874
550	40.14	129	100	H	550	-55.33	0	0.5	-55.83	-54	-1.83
550	39.87	252	133	V	550	-54.92	0	0.5	-55.42	-54	**-1.42**
750	28.78	209	135	H	750	-63.95	0	0.54	-64.49	-54	-10.49
650	26.04	175	141	V	650	-66.78	0	0.58	-67.36	-54	-13.36
450	35.48	156	149	H	450	-61.97	0	0.4	-62.37	-36	-26.37
450	32.09	232	112	V	450	-64.32	0	0.4	-64.72	-36	-28.72

Conducted TX Spurious Emission:

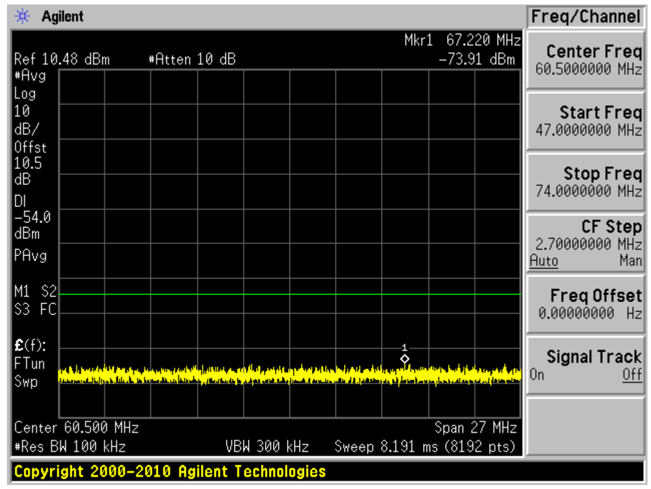
Note: all the emissions have more than 2.5 dB margin from the limits, so after adding the peak antenna gain 2.5dBi, all the emissions can still pass.

GFSK, Low Channel

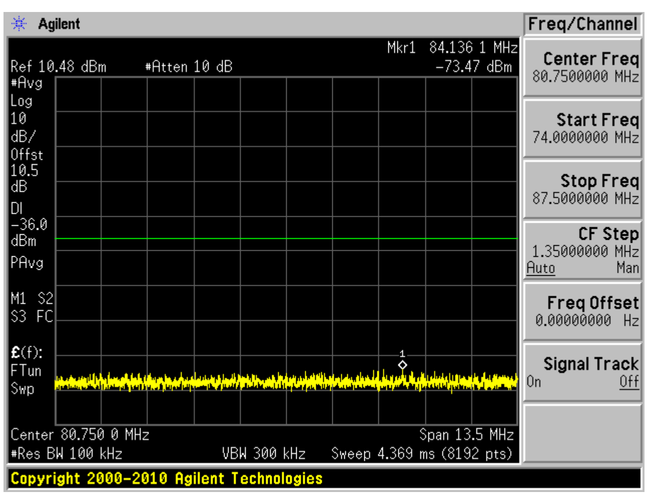
30MHz to 47MHz



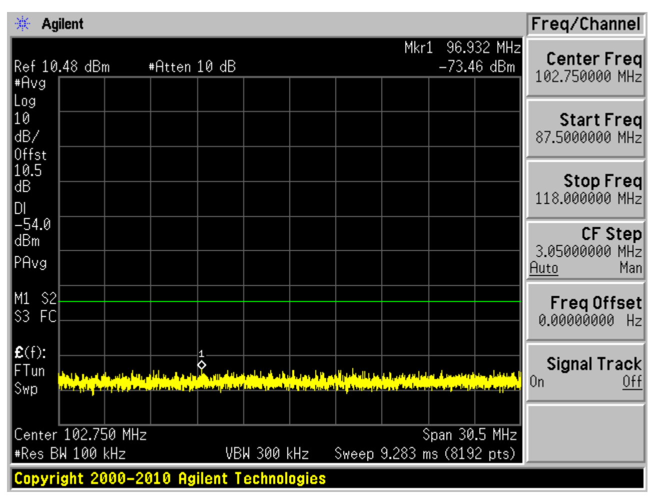
47 MHz to 74MHz



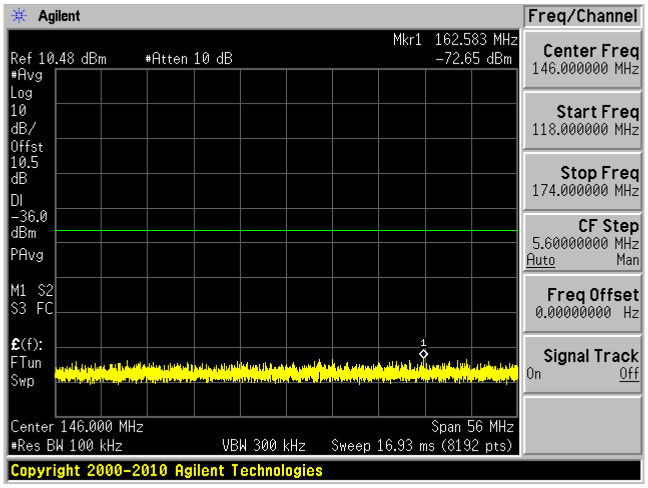
74MHz to 87.5MHz



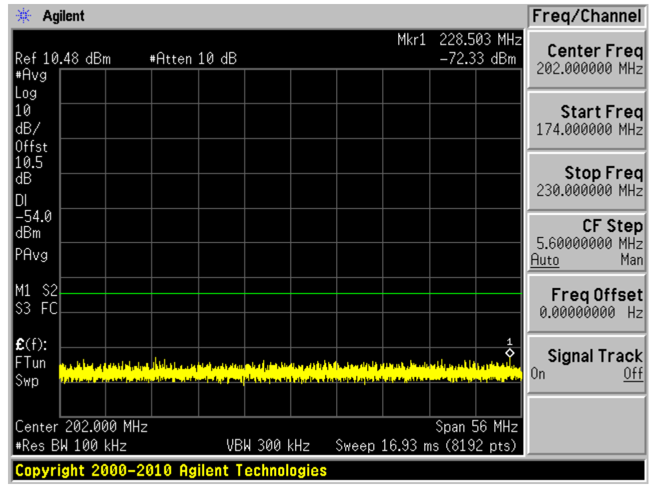
87.5 MHz to 118MHz



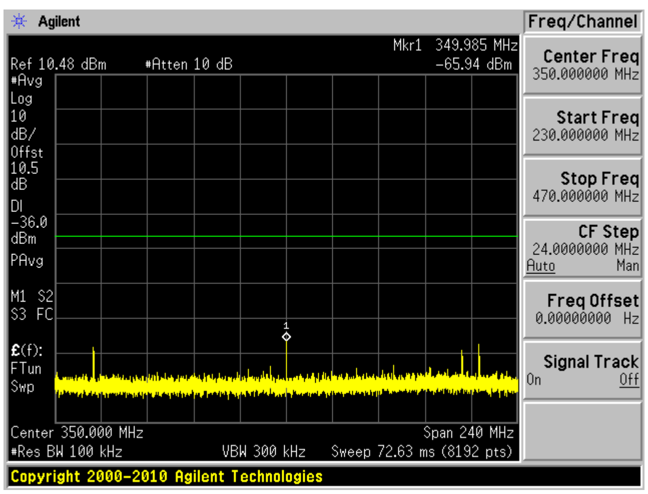
118MHz to 174MHz



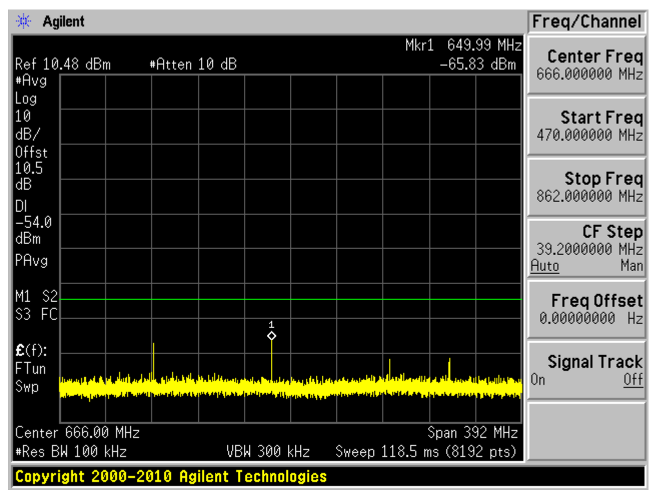
174MHz to 230MHz



230MHz to 470MHz

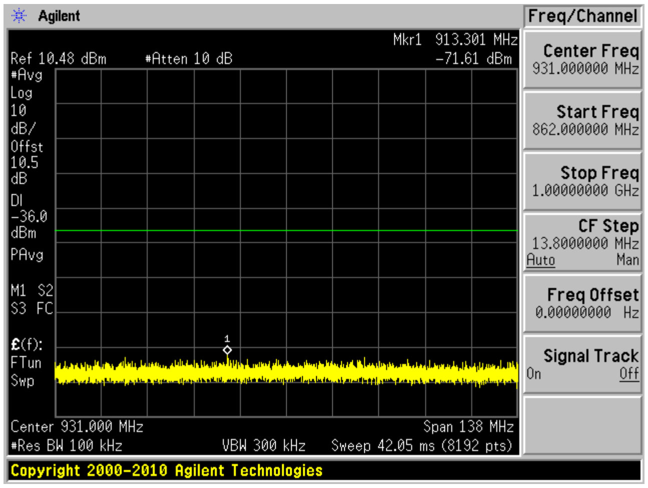


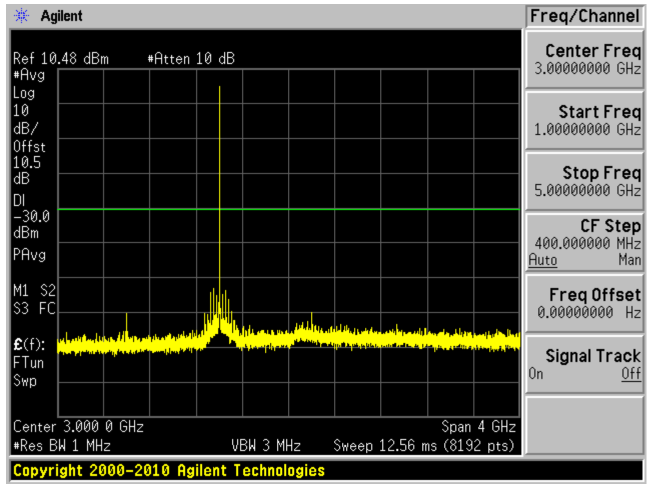
470MHz to 862MHz



862MHz to 1GHz

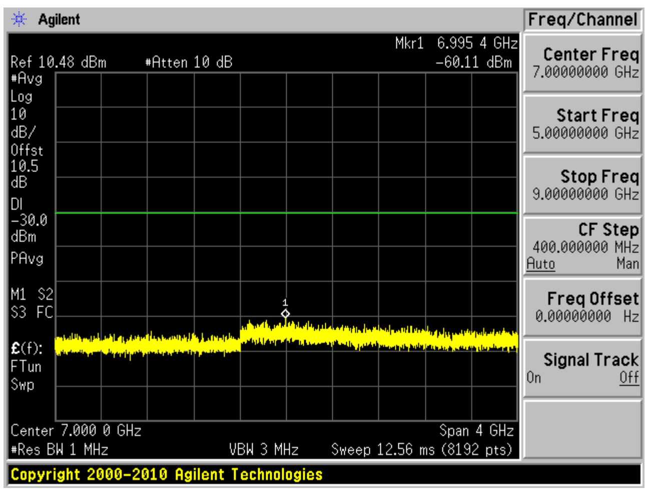
1GHz to 5GHz

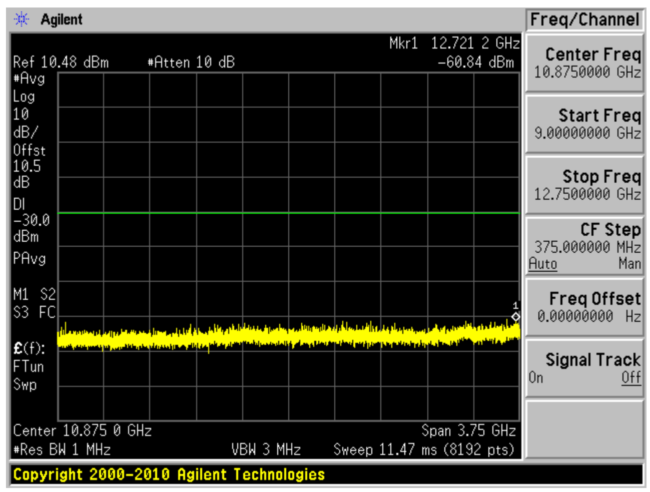




5GHz to 9GHz

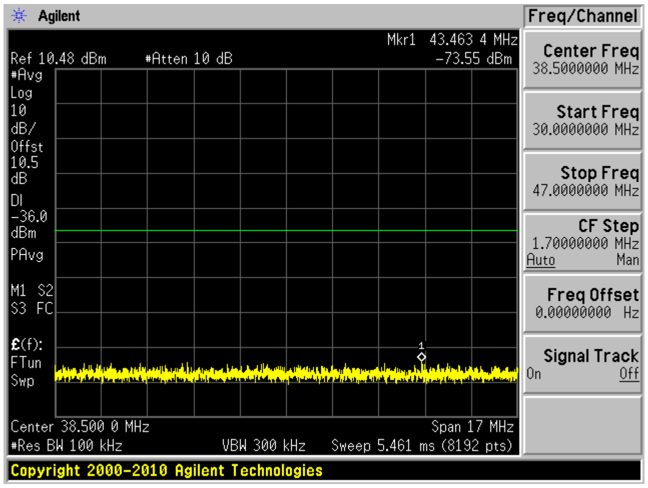
9GHz to 12.75GHz



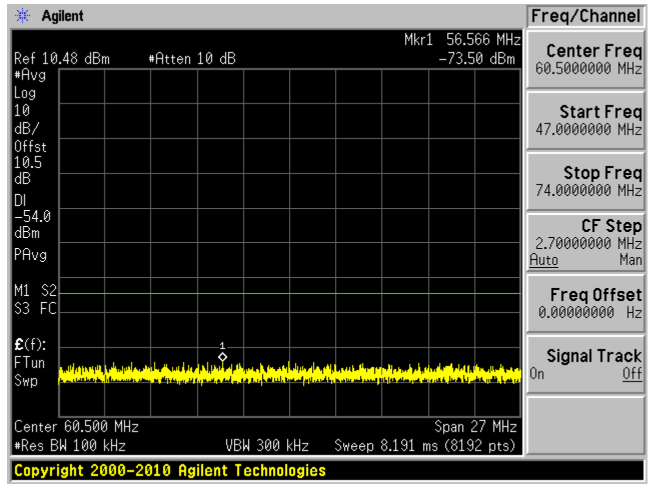


GFSK, High Channel

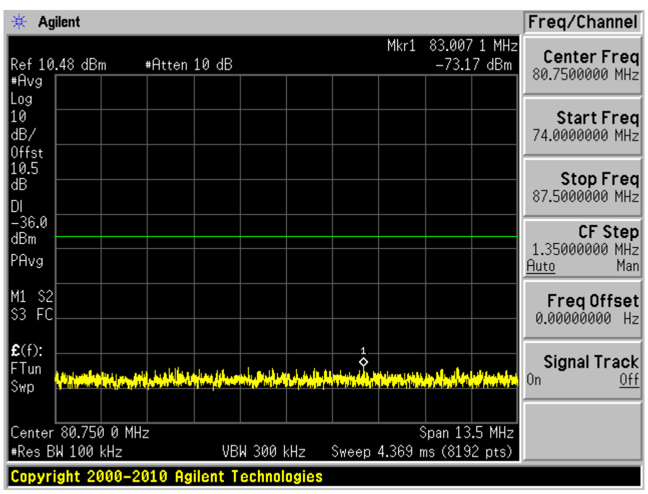
30MHz to 47MHz



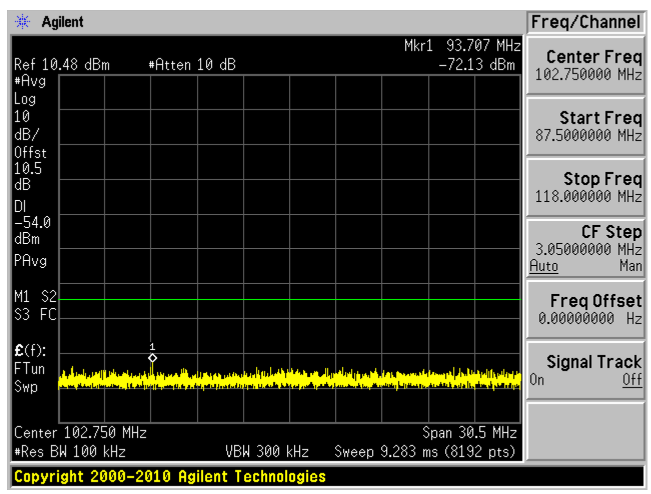
47MHz to 74MHz



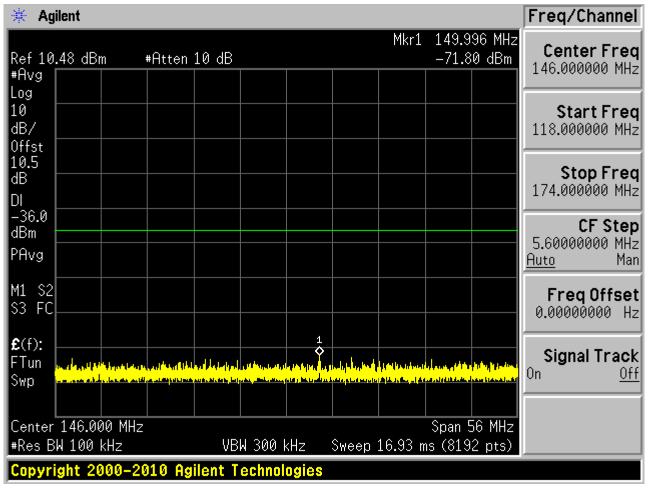
74MHz to 87.5MHz



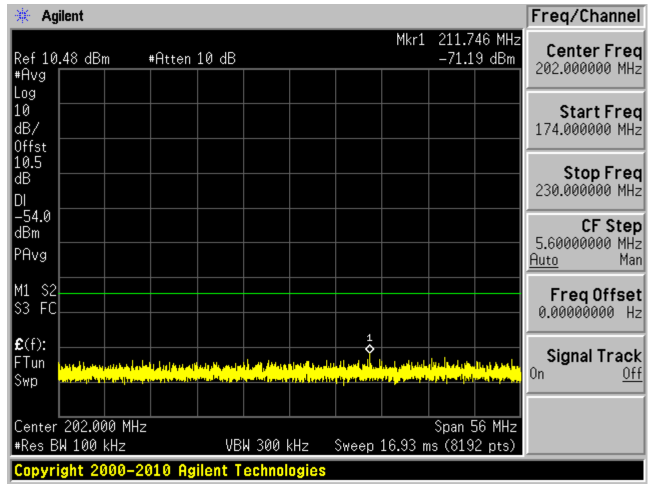
87.5MHz to 118MHz



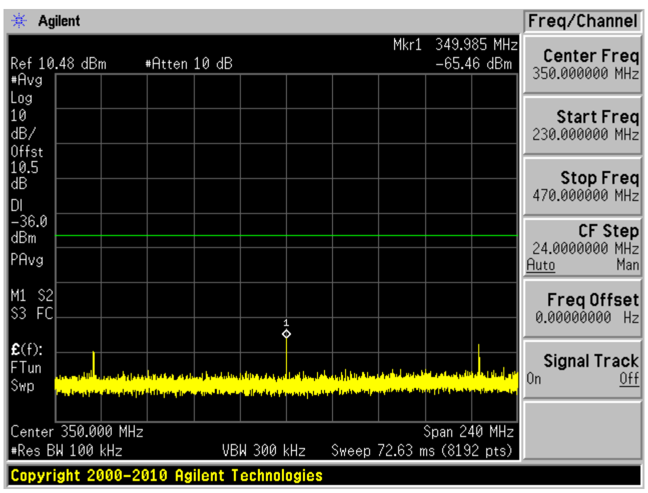
118MHz to 174MHz



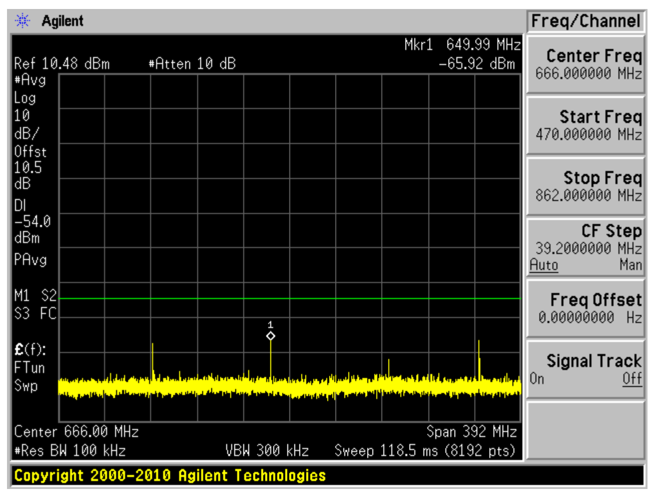
174MHz to 230MHz



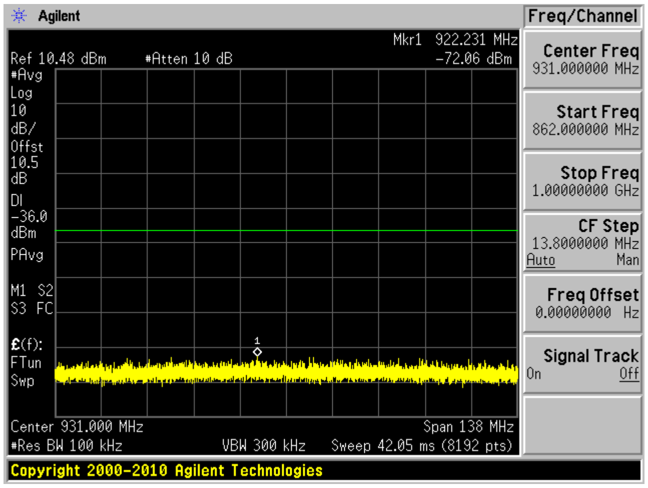
230MHz to 470MHz



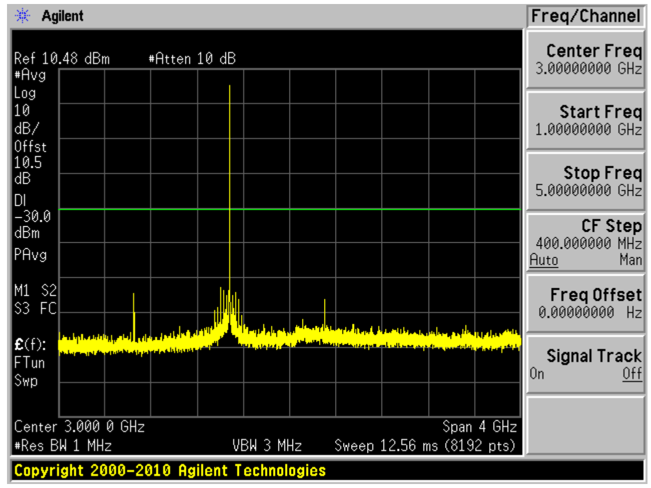
470MHz to 862MHz



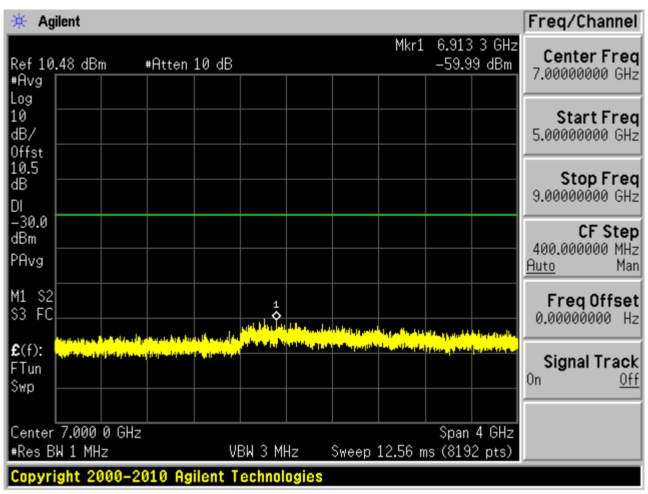
862MHz to 1GHz



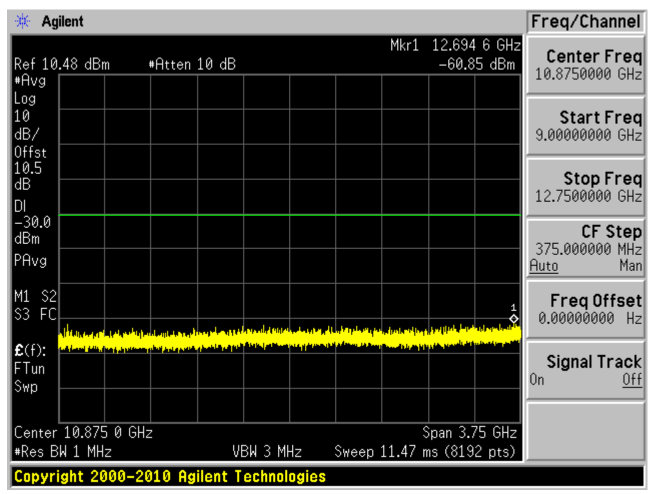
1GHz to 5GHz



5GHz to 9GHz

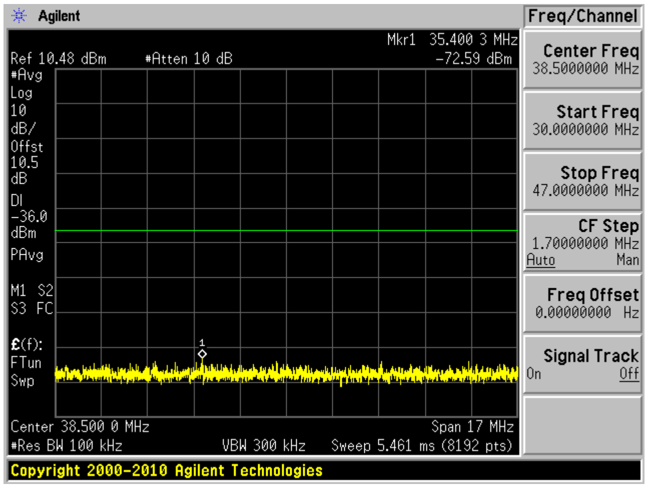


9GHz to 12.75GHz

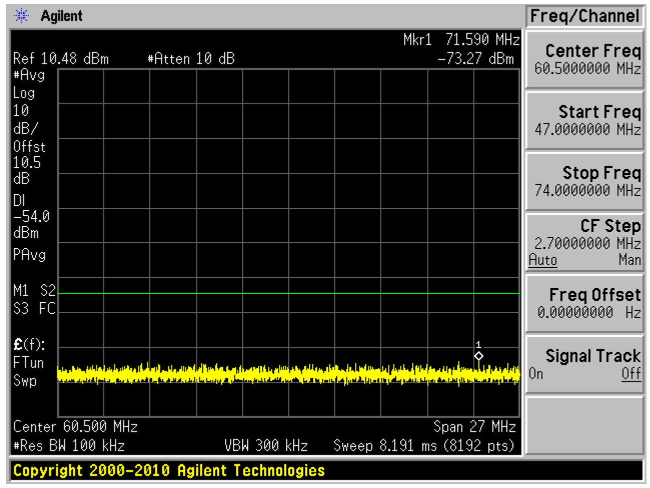


Π/4-DQPSK, Low Channel

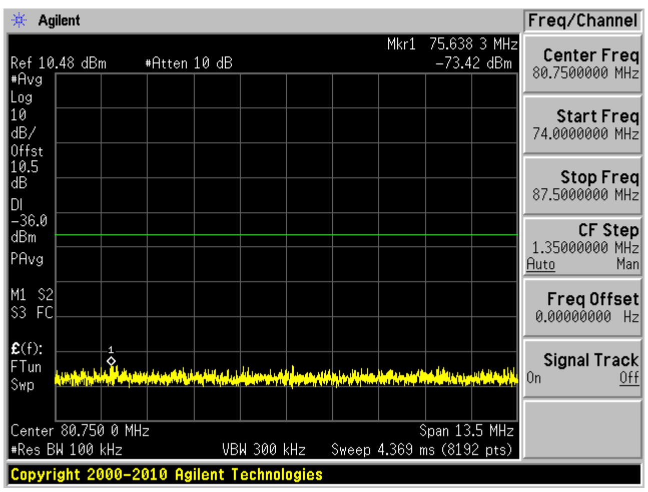
30MHz to 47MHz



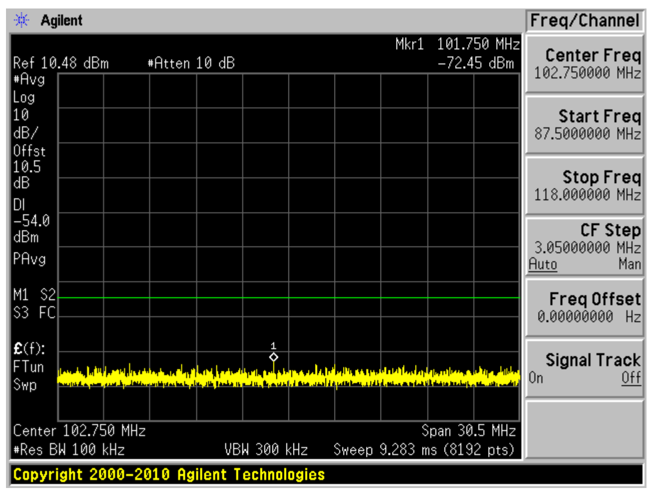
47MHz to 74MHz



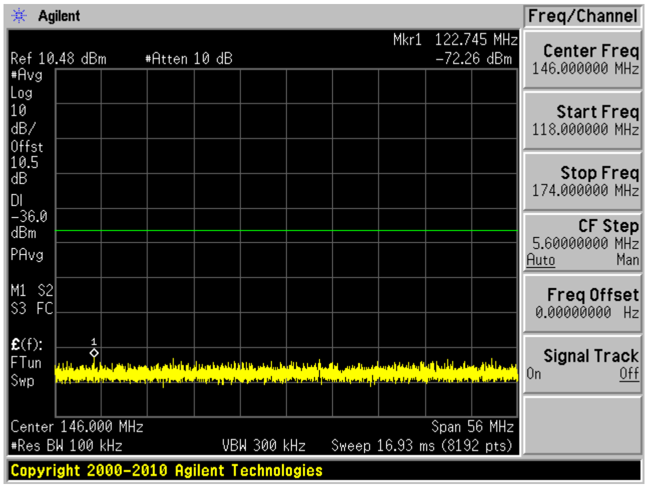
74MHz to 87.5MHz



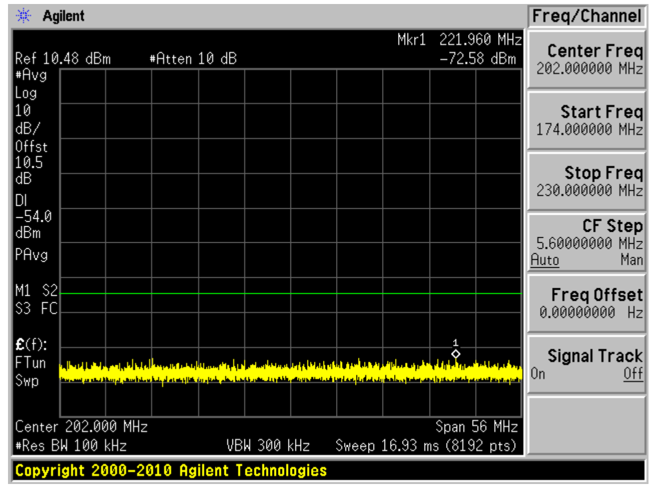
87.5MHz to 118MHz



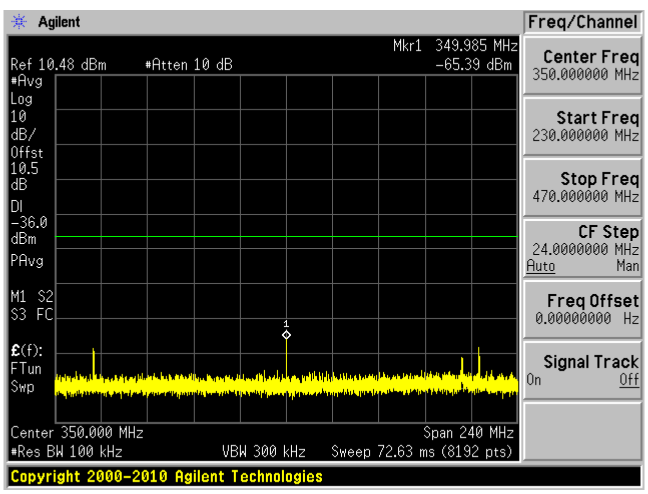
118MHz to 174MHz



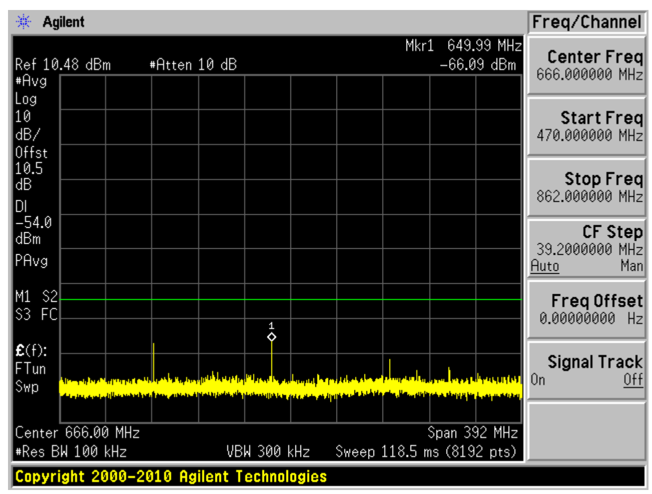
174MHz to 230MHz



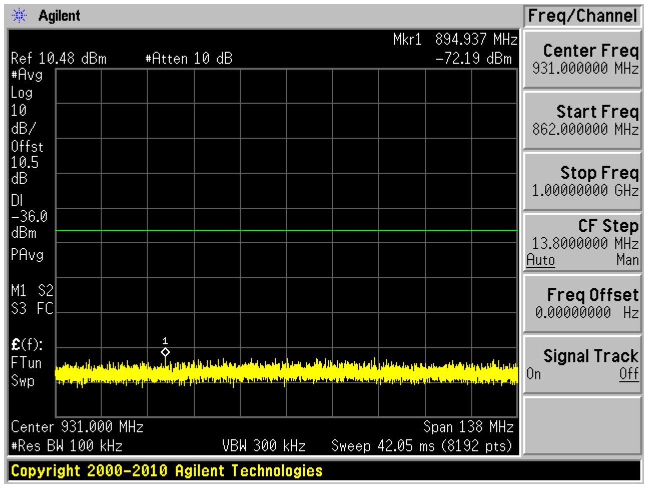
230MHz to 470MHz



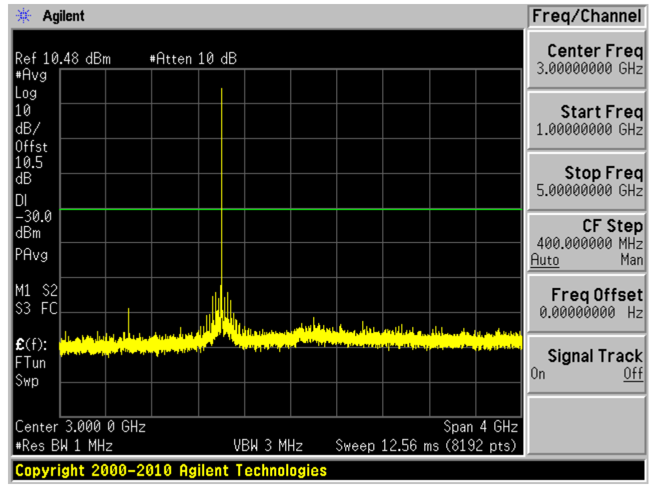
470MHz to 862MHz



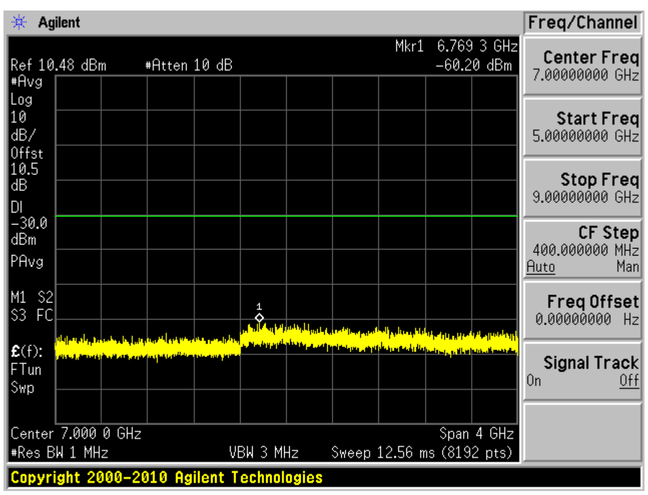
862MHz to 1GHz



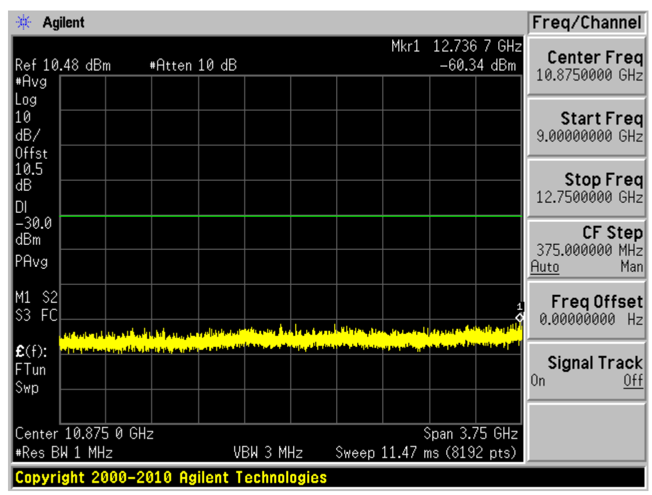
1GHz to 5GHz



5GHz to 9GHz

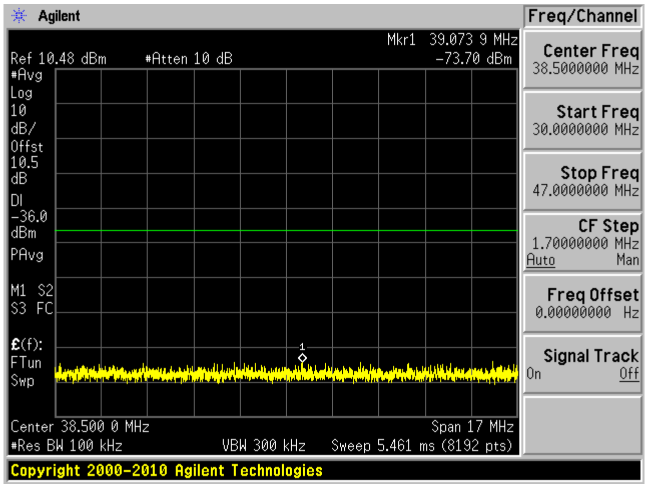


9GHz to 12.75GHz

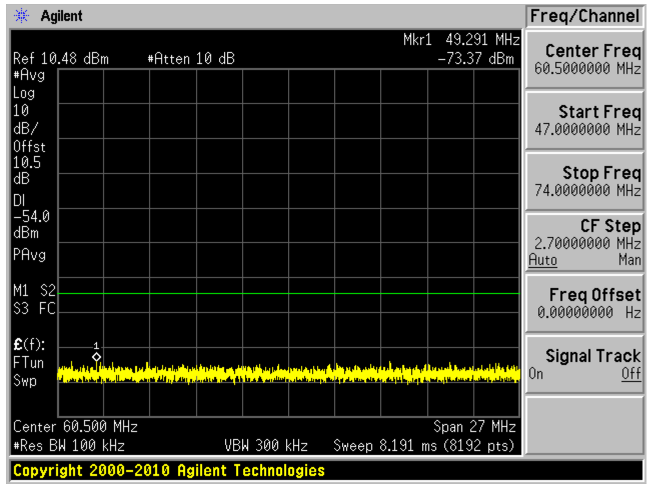


Π/4-DQPSK, High Channel

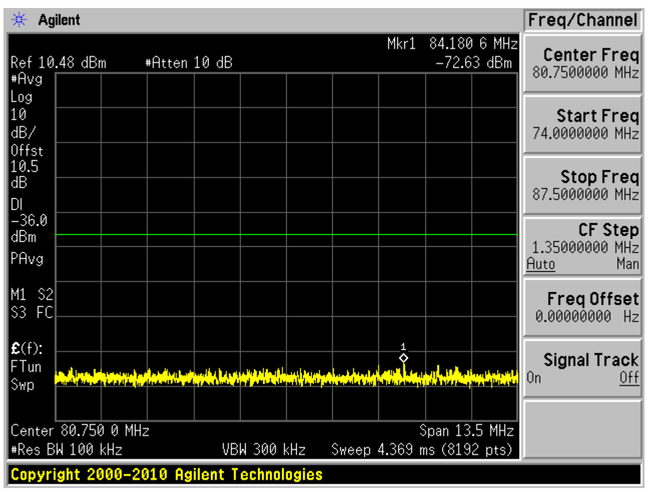
30MHz to 47MHz



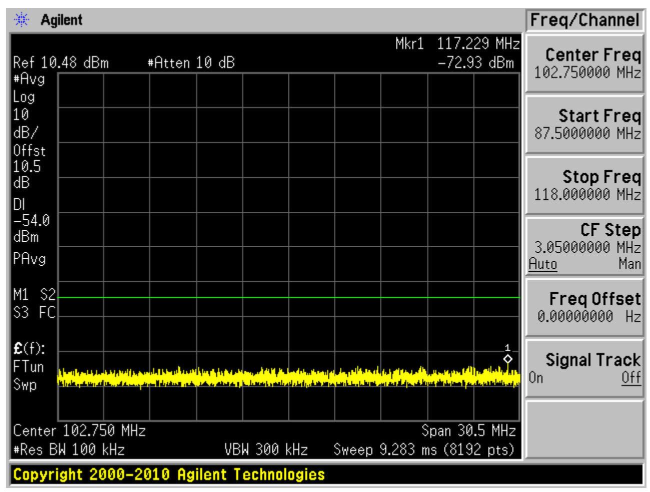
47MHz to 74MHz



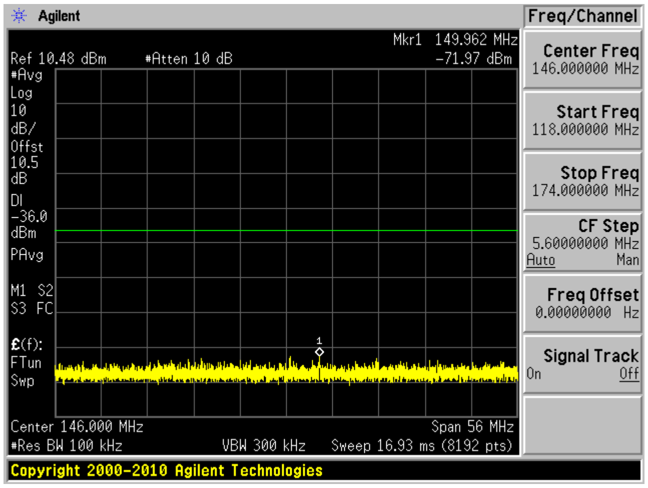
74MHz to 87.5MHz



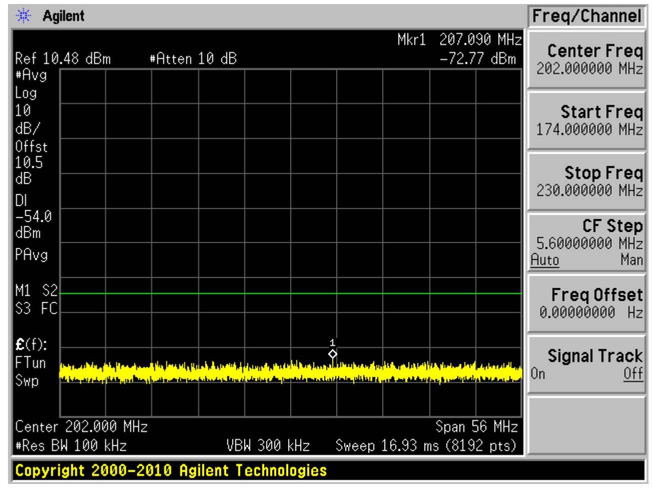
87.5MHz to 118MHz



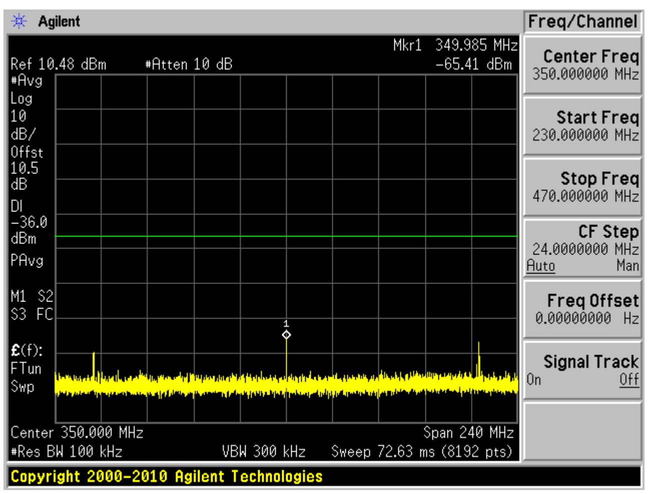
118MHz to 174MHz



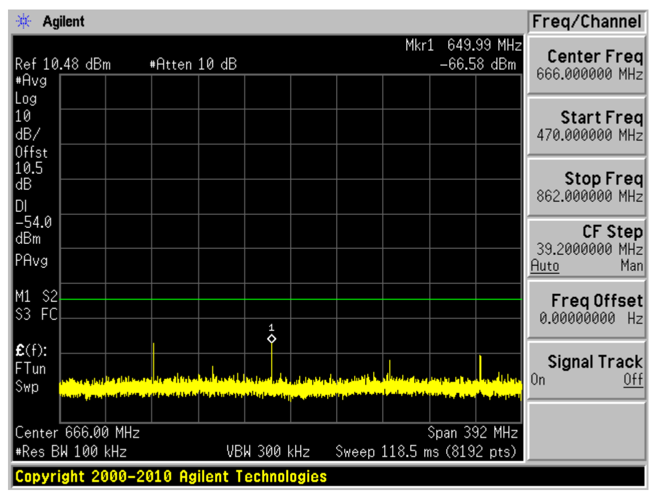
174MHz to 230MHz



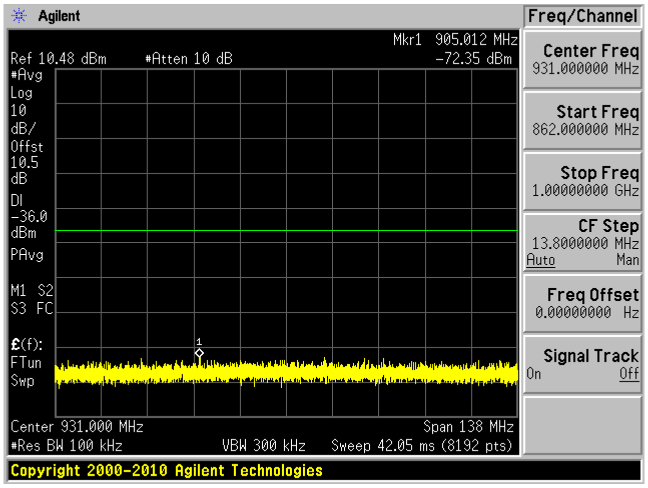
230MHz to 470MHz



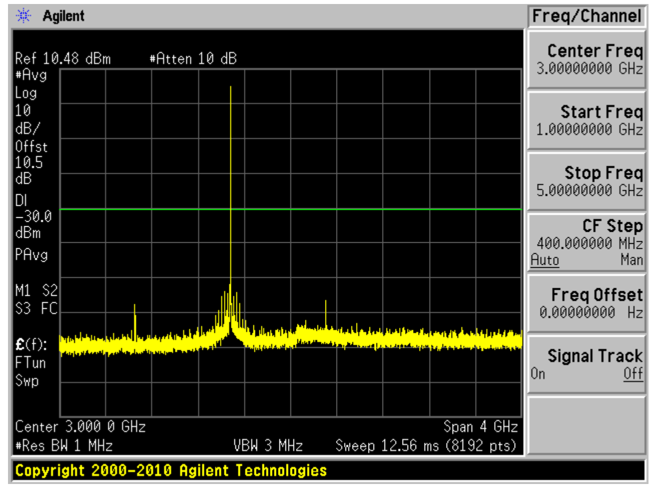
470MHz to 862MHz



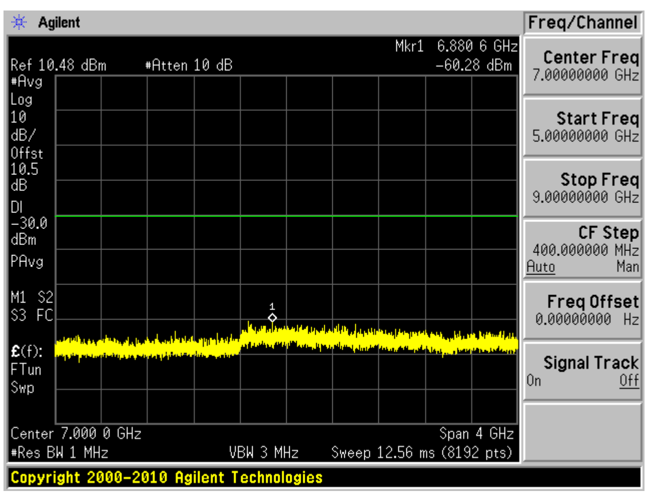
862MHz to 1GHz



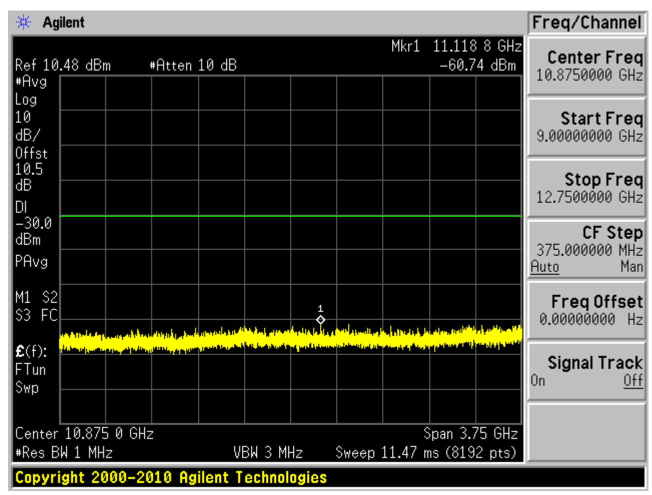
1GHz to 5GHz



5GHz to 9GHz

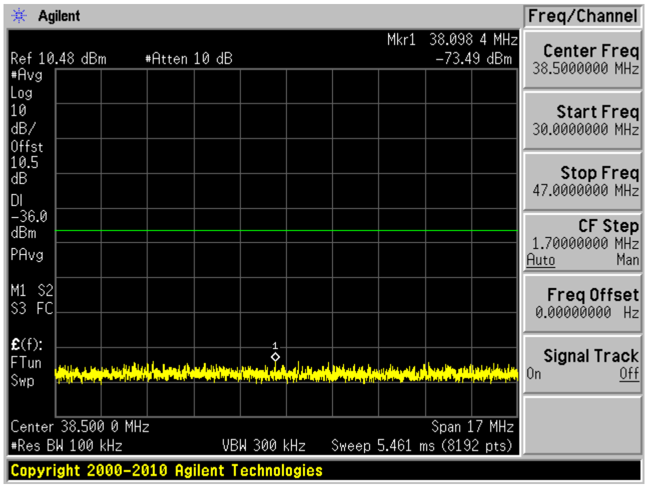


9GHz to 12.75GHz

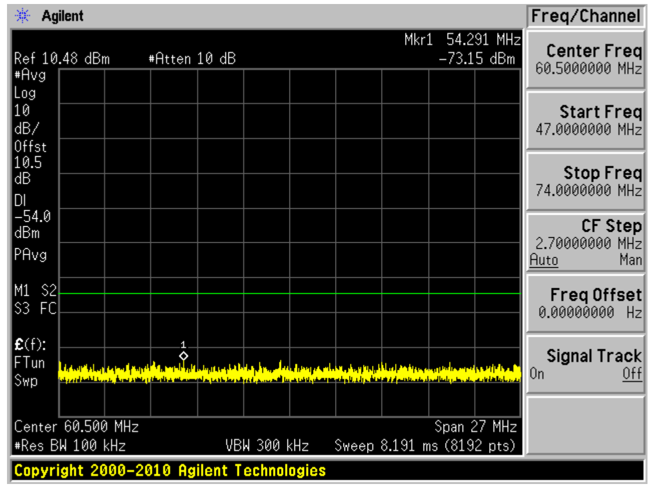


8PSK, Low Channel

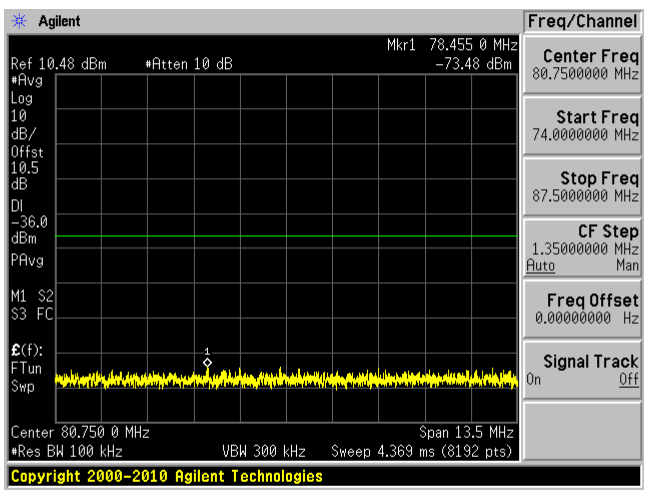
30MHz to 47MHz



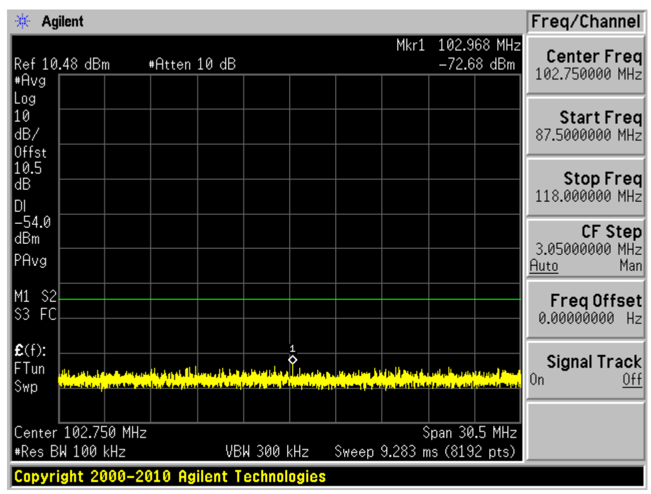
47MHz to 74MHz



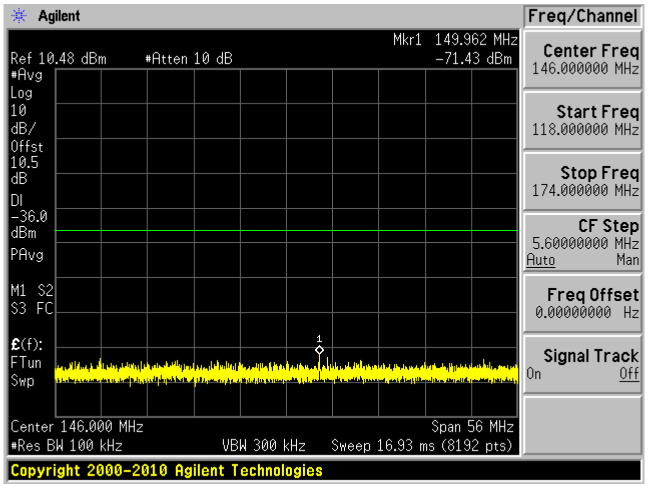
74MHz to 87.5MHz



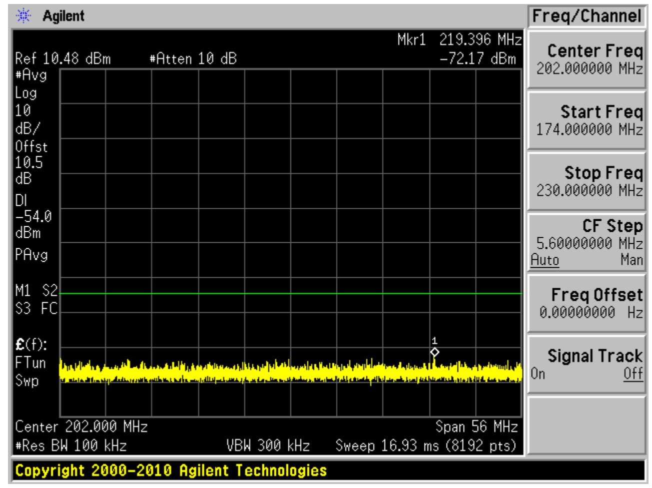
87.5MHz to 118MHz



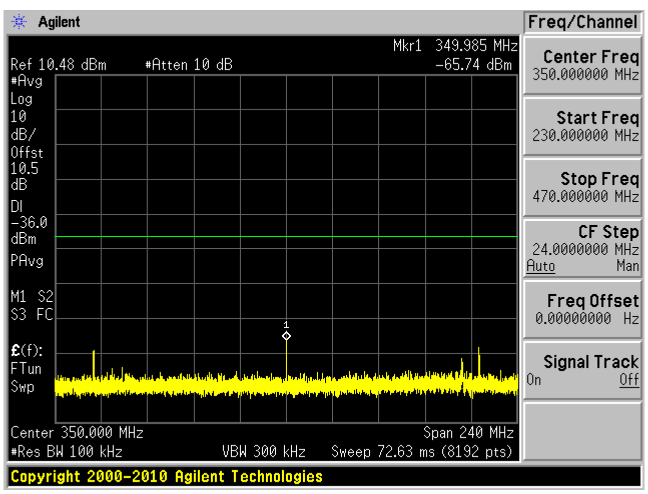
118MHz to 174MHz



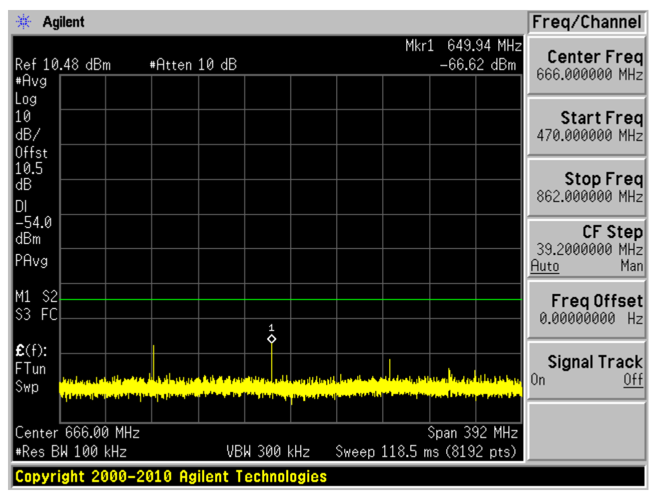
174MHz to 230MHz



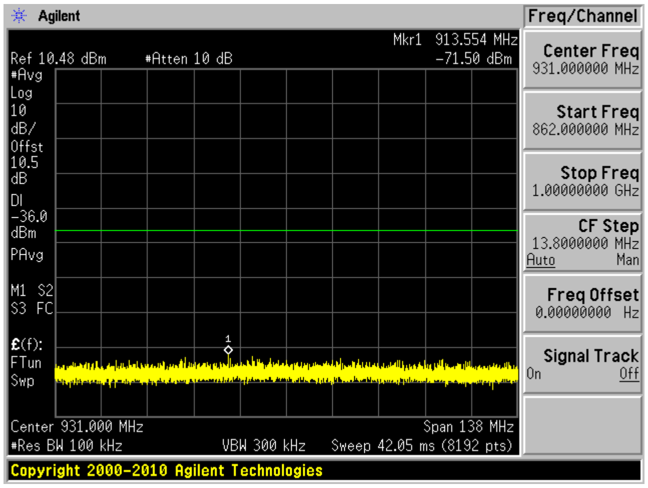
230MHz to 470MHz



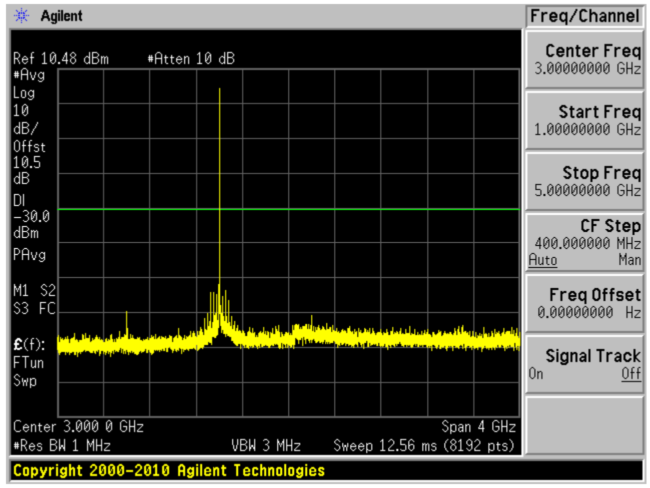
470MHz to 862MHz



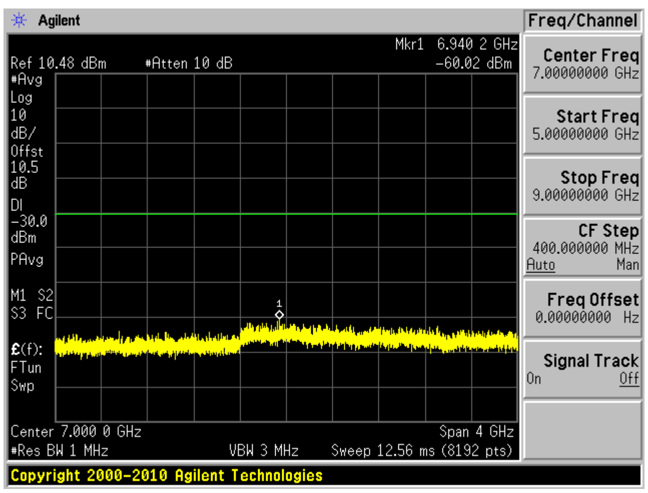
862MHz to 1GHz



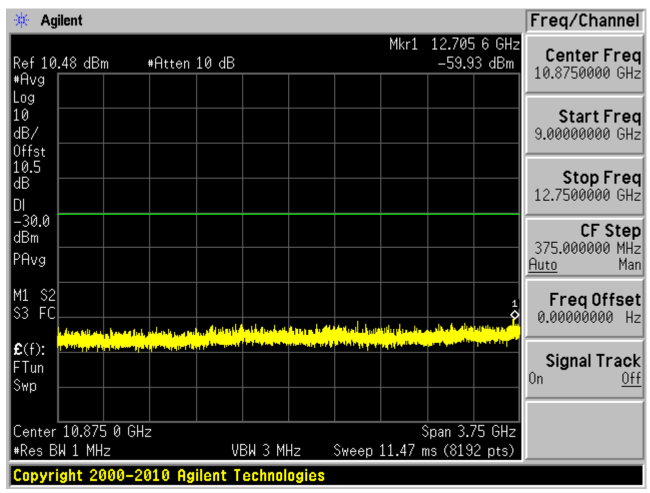
1GHz to 5GHz



5GHz to 9GHz

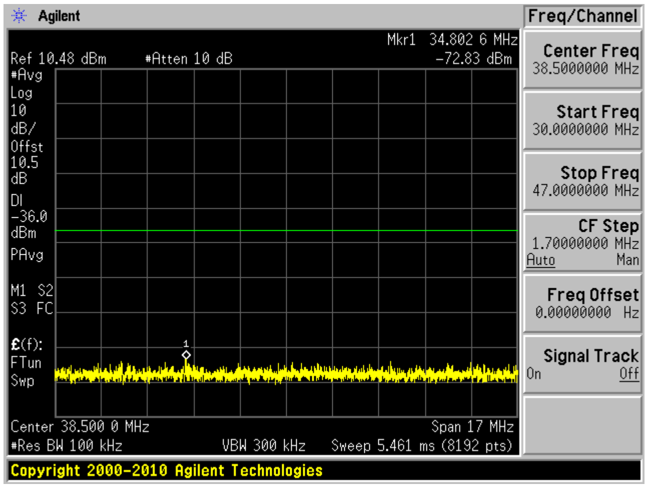


9GHz to 12.75GHz

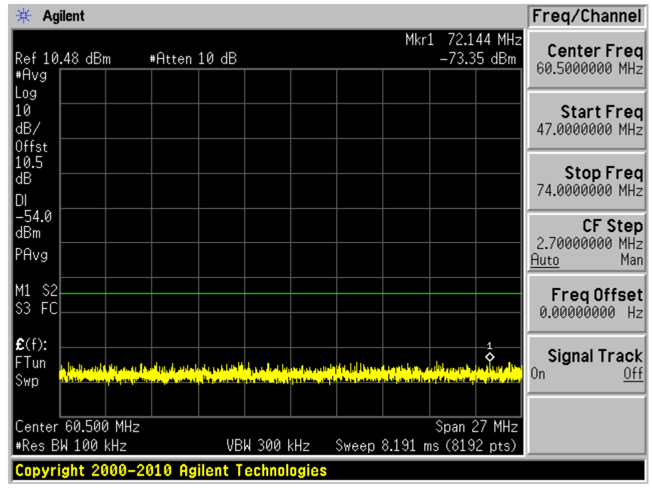


8PSK, High Channel

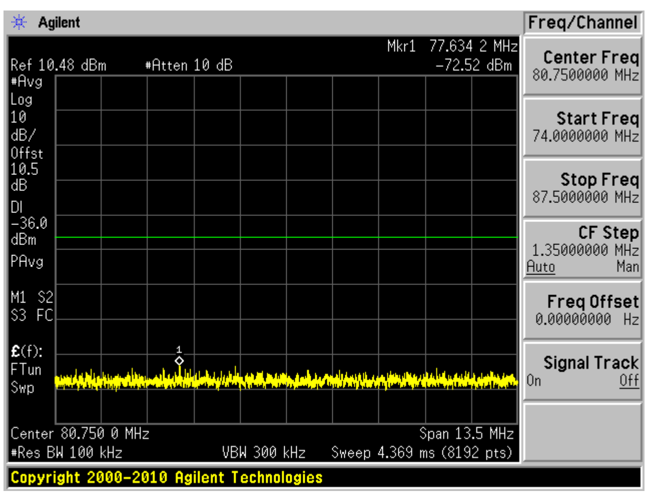
30MHz to 47MHz



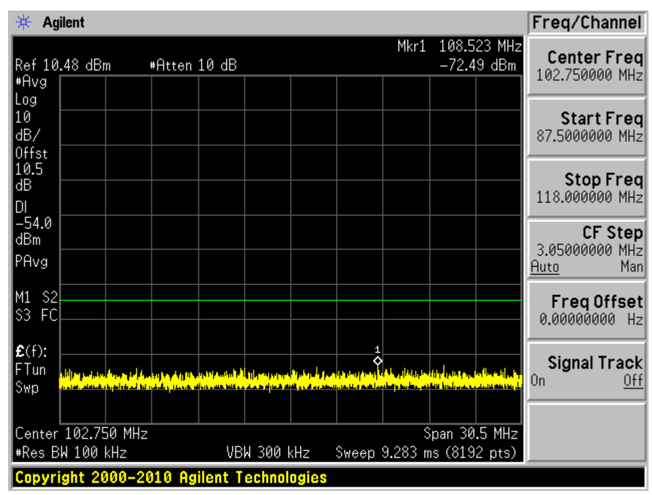
47MHz to 74MHz



74MHz to 87.5MHz

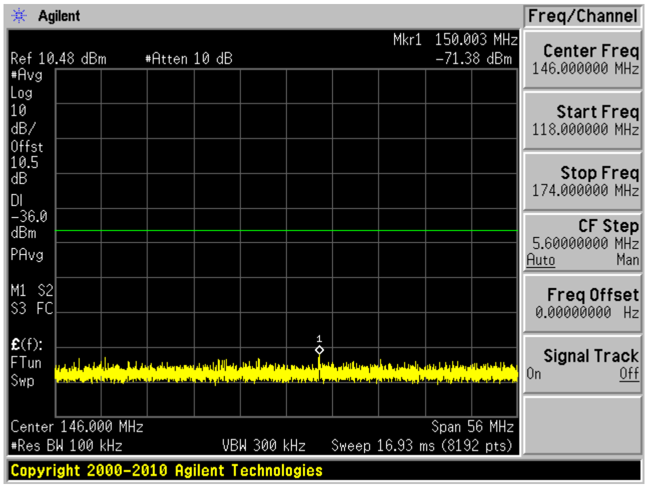


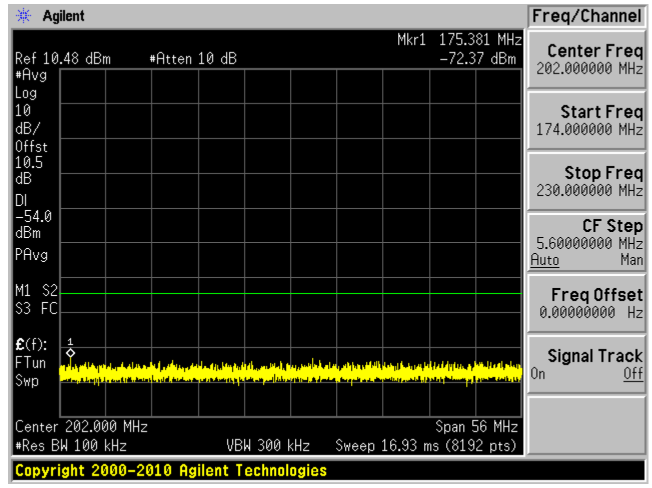
87.5MHz to 118MHz



118MHz to 174MHz

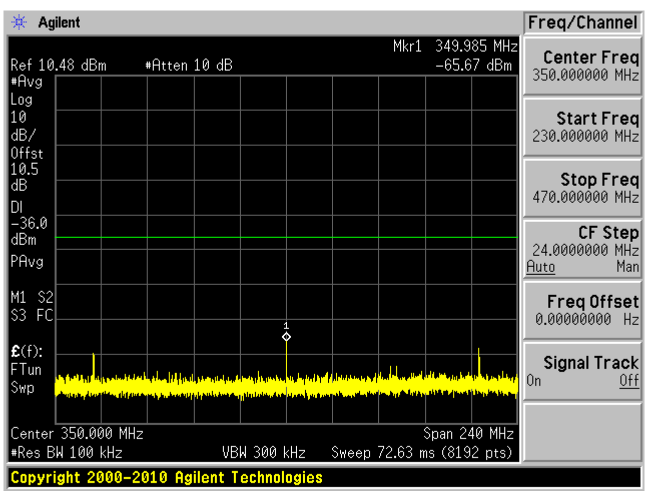
174MHz to 230MHz

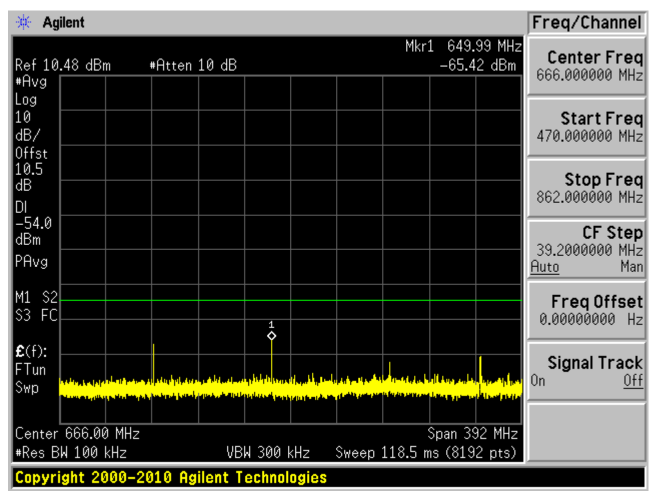




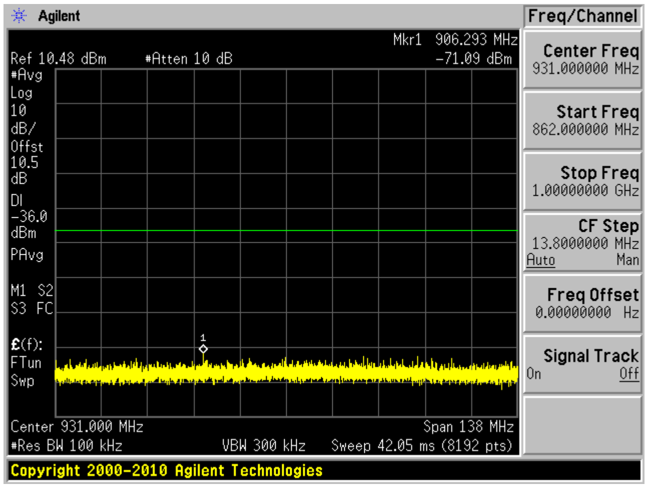
230MHz to 470MHz

470MHz to 862MHz

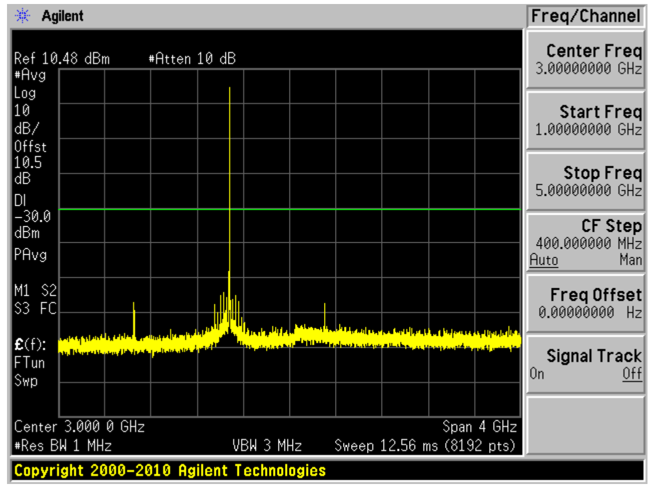




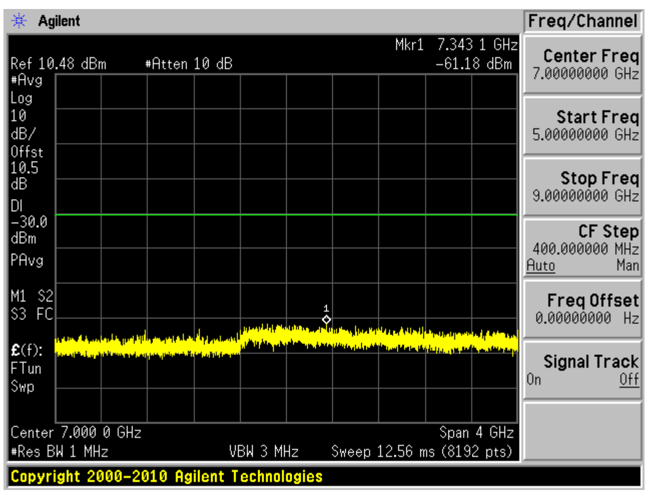
862MHz to 1GHz



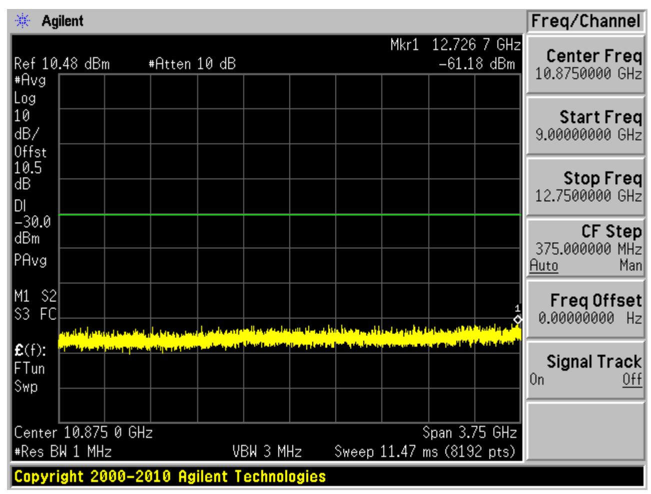
1GHz to 5GHz



5GHz to 9GHz



9GHz to 12.75GHz



10 EN 300 328 § 4.3.1.11 Receiver spurious emissions

10.1 Applicable Standard

According to EN 300 328-1 V1.9.1, spurious emissions of the receiver shall not exceed the values in following table:

Table 2: Spurious emission limits for receivers

Frequency range	Maximum power	Measurement bandwidth
30 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 12,75 GHz	-47 dBm	1 MHz

10.2 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at BACL is ±4.0 dB.

10.3 EUT Setup

The radiated emissions tests were performed in a shield room, using the setup accordance with the EN 300 328 V1.9.1. The specification used was the EN 300 328 V1.9.1 limits.

External I/O cables were draped along the edge of the test table and bundle when necessary.

10.4 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corrected Amplitude = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dBµV means the emissions are 7dBµV below the maximum limit for EN 300 328-1 V1.7.1. The equation for margin calculation is as follows:

Margin = Standard Limit – Corrected Amplitude

10.5 Environmental Conditions

Temperature:	24-26º C
Relative Humidity:	45-48 %
ATM Pressure:	101-102 kPa

Testing was performed by Jin Yang on 2015-10-28 at RF site and 5M3 chamber.

10.6 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2015-06-22	1 year
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	N/R
Sunol Science Corp	Combination Antenna	JB3	A020106-3	2015-07-11	1 year
Hewlett Packard	Pre-amplifier	8447D	2944A10187	2015-03-20	1 year
HP/ Agilant	Pre Amplifier	8449B OPT HO2	3008A0113	2015-03-11	1year
Sunol	Horn antenna	DRH-118	A052704	2015-03-09	1 year
EMCO	Antenna, Horn	3115	9511-4627	2015-01-15	1 year
HP	Signal Generator	83650B	18485-91	2015-08-19	1 year
COM-POWER	Antenna, Dipole	AD-100	721033DB1,721033DB2,721033DB3,721033DB4,	2014-11-03	2 year

Statement of Traceability: BACL attests that all calibrations have been performed per the A2LA requirements, traceable to NIST.

10.7 Measurement Procedure

For the radiated emissions test, the EUT and all support equipment power cords were connected to the AC floor outlet since the power supply used in the EUT did not provide an accessory power outlet.

Maximization procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations. All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dBμV of specification limits), and are distinguished with a "**QP**" in the data table.

10.8 Summary of Test Results

According to the recorded data, the EUT complied with the EN 300 328 V1.9.1 standards' limits and had the worst margin of:

-1.31 at 550 **MHz** in the Vertical polarization

Please refer to the following table and plots for detailed test results

Radiated spurious emission:

RX:

Low Channel

Freq. (MHz)	S.A. Amp. (dBμV)	Table Azimuth (Degrees)	Test Antenna		Substitution				Absolute Level (dBm)	EN 300 328	
			Height (cm)	Polar (H/V)	Freq. (MHz)	S.G. Level (dBm)	Antenna Gain (dBi)	Cable Loss (dB)		Limit (dBm)	Margin (dB)
3200	43.85	0	100	H	3200	-60.32	9.585	1.01	-51.745	-47	-4.745
3200	43.54	0	100	V	3200	-60.14	9.666	1.01	-51.484	-47	-4.484
550	37.2	241	102	H	550	-58.27	0	0.5	-58.77	-57	-1.77
550	36.98	129	100	V	550	-57.81	0	0.5	-58.31	-57	**-1.31**
650	28.11	238	100	H	650	-65.53	0	0.58	-66.11	-57	-9.11
650	28.29	146	113	V	650	-64.53	0	0.58	-65.11	-57	-8.11
350	30.21	233	100	H	350	-69	0	0.4	-69.4	-57	-12.4
350	30.07	138	105	V	350	-68.61	0	0.4	-69.01	-57	-12.01

High Channel

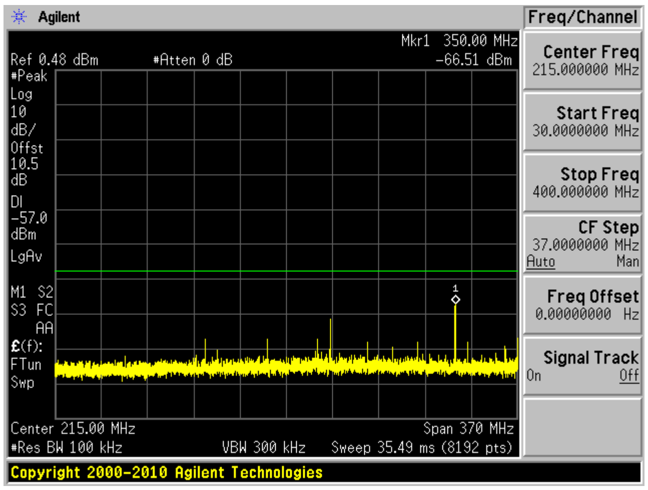
Freq. (MHz)	S.A. Amp. (dBμV)	Table Azimuth (Degrees)	Test Antenna		Substitution				Absolute Level (dBm)	EN 300 328	
			Height (cm)	Polar (H/V)	Freq. (MHz)	S.G. Level (dBm)	Antenna Gain (dBi)	Cable Loss (dB)		Limit (dBm)	Margin (dB)
3304	43.83	0	100	H	3304	-60.38	9.617	1.03	-51.793	-47	-4.793
3304	43.14	0	100	V	3304	-60.45	9.61	1.03	-51.87	-47	-4.87
550	36.68	242	100	H	550	-58.79	0	0.5	-59.29	-57	-2.29
550	36.43	137	111	V	550	-58.36	0	0.5	-58.86	-57	-1.86
650	28.9	247	100	H	650	-64.74	0	0.58	-65.32	-57	-8.32
650	28.76	148	121	V	650	-64.06	0	0.58	-64.64	-57	-7.64
350	31.39	240	112	H	350	-67.82	0	0.4	-68.22	-57	-11.22
350	30.48	143	100	V	350	-68.2	0	0.4	-68.6	-57	-11.6

Conducted Receiver Spurious Emission:

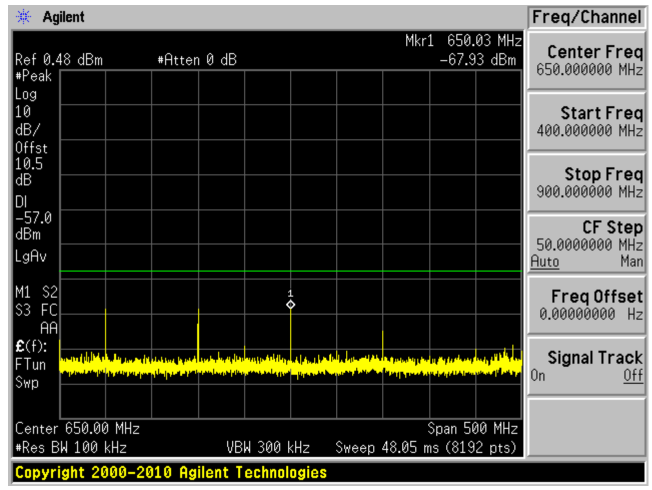
Note: all the emissions have more than 2.5 dB margin from the limits, so after adding the peak antenna gain 2.5dBi, all the emissions can still pass.

Low Channel

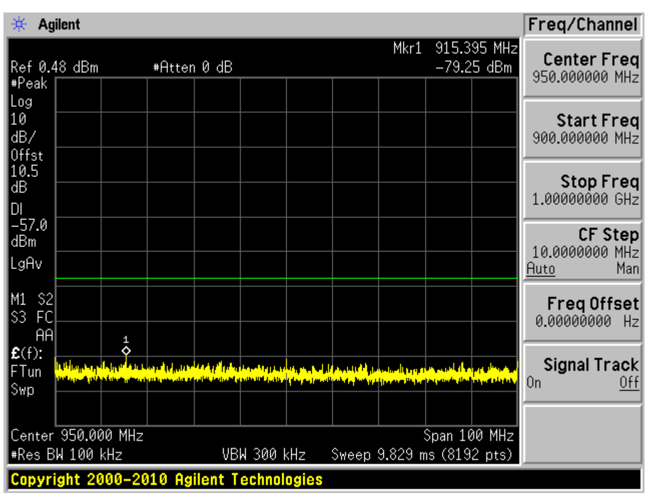
30 MHz to 400 MHz



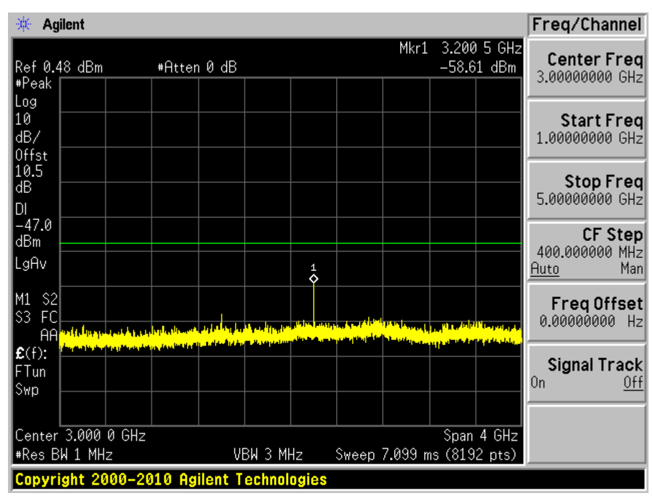
400 MHz to 900 MHz



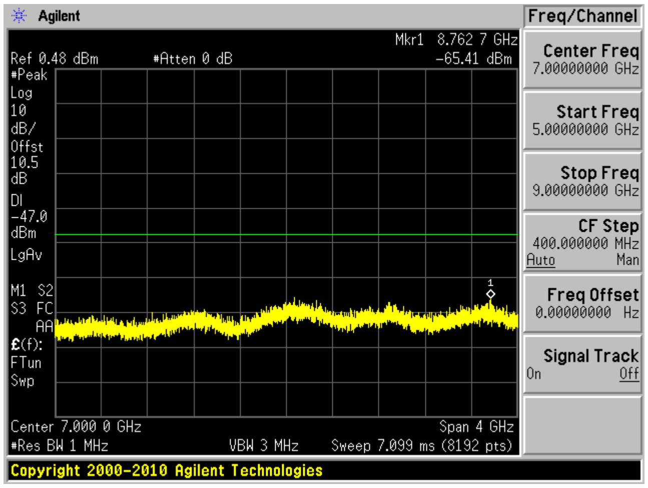
900 MHz to 1 GHz



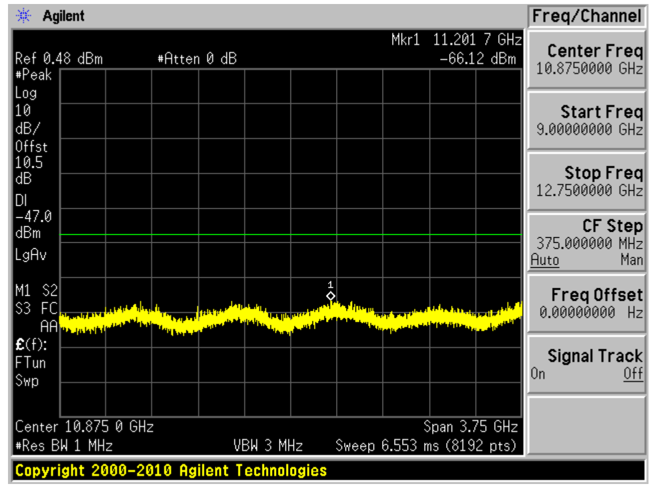
1 GHz to 5 GHz



5 GHz to 9 GHz

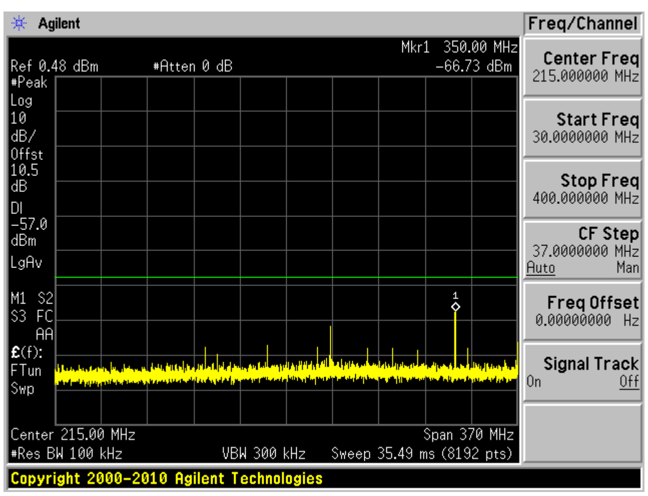


9 GHz to 12.75 GHz

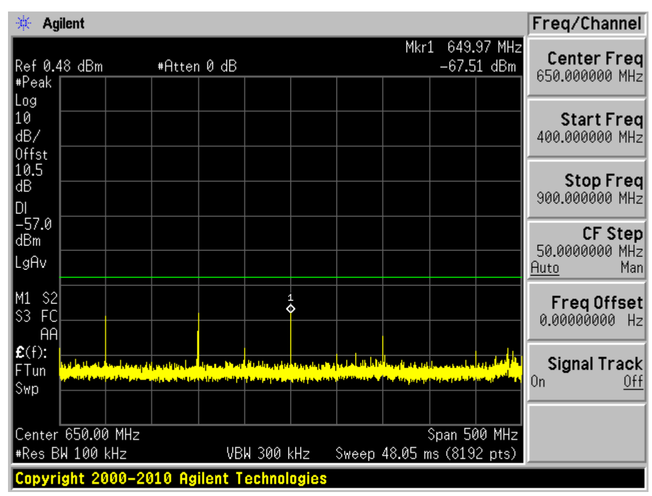


High Channel

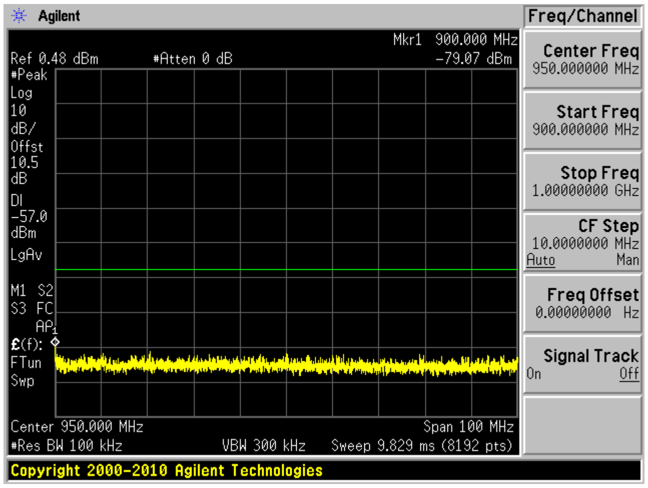
30 MHz to 400 MHz



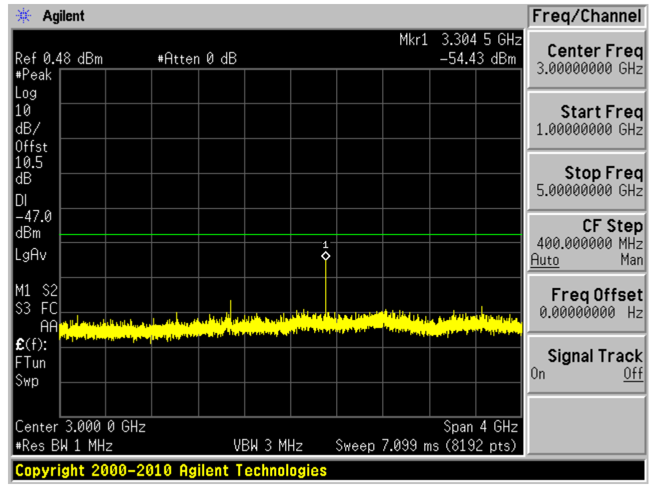
400 MHz to 900 MHz



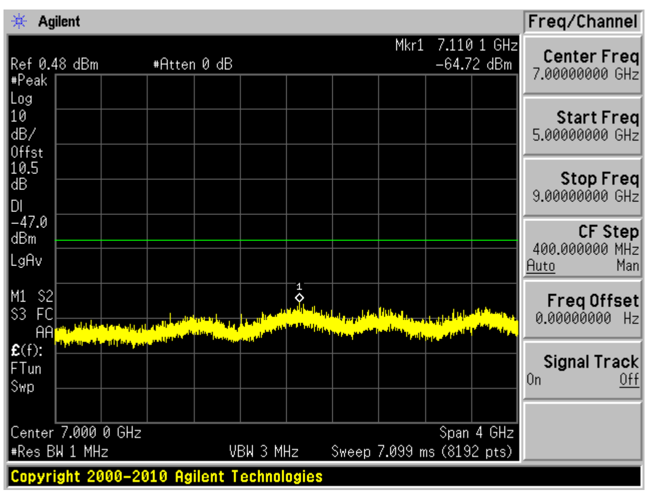
900 MHz to 1 GHz



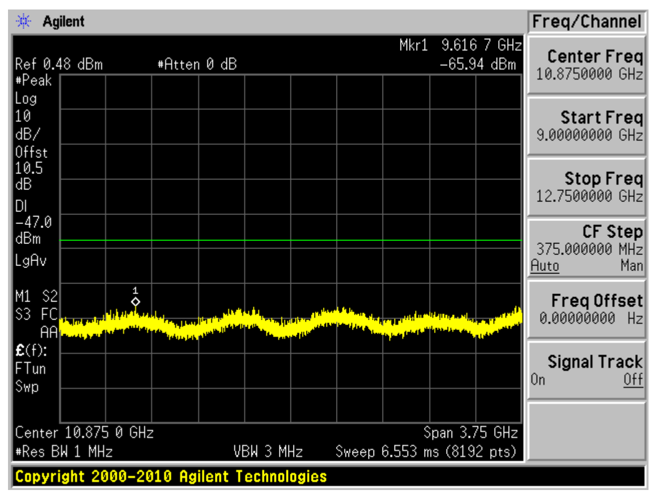
1 GHz to 5 GHz



5 GHz to 9 GHz



9 GHz to 12.75 GHz



11 xhibit A – Proposed Product Labeling

11.1 Label Information

1. The CE conformity marking must consist of the initials ‘CE’ taking the form below. If the CE marking is reduced or enlarged the proportions must be respected.

2. The CE marking must have a height of at least 5 mm except where this is not possible on account of the nature of the apparatus.

   The EMC Directive recognizes that there are circumstances where it is “not possible or warranted on account of the nature of the product” to have the marking affixed to the apparatus or to its data plate. In such cases it is allowed to have the CE marking’ affixed on the packaging, refer to the Blue Guide when such exemptions are allowed.

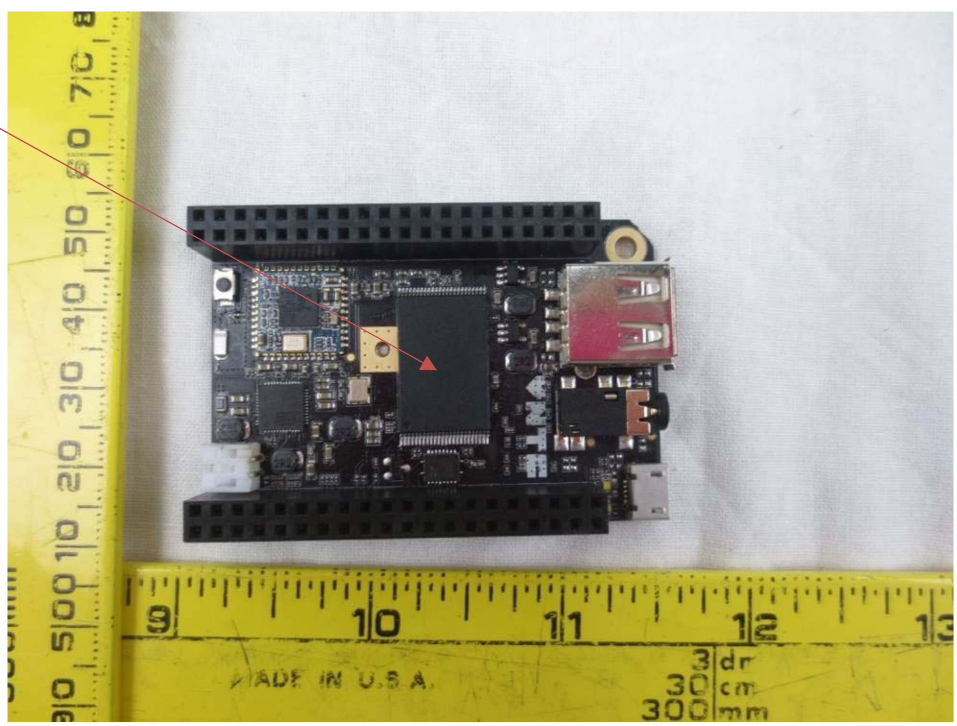
3. The CE marking must be affixed to the product or to its data plate. Additionally it must be affixed to the packaging, if any, and to the accompanying documents, where the directive concerned provides for such documents.

4. The CE marking must be affixed visibly, legibly, and indelibly.

5. Other labeling requirements maybe required if the product(s) is/are subject to several directives.

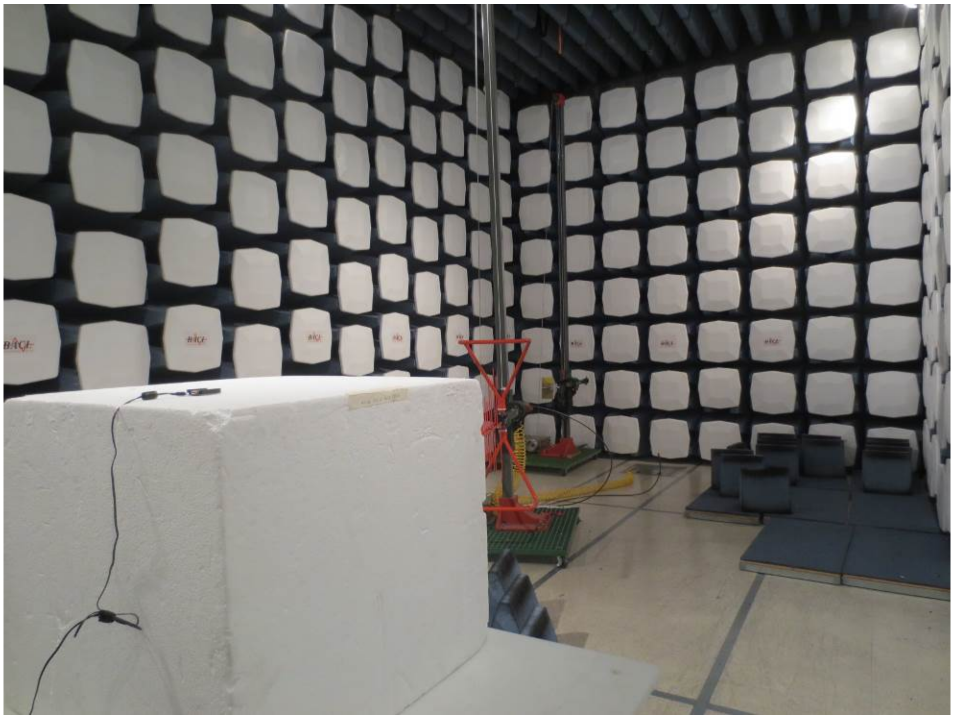
Specifications: Text is black or white in color and is left justified. Labels are printed in indelible ink on permanent adhesive backing or silk-screened and shall be affixed at a conspicuous location on the EUT. The label can not be positioned on a removable portion of the EUT (e.g. battery cover).

11.2 Suggested Label Location



12 Exhibit B - Test Setup Photographs

12.1 Radiated Emission below 1 GHz Front View



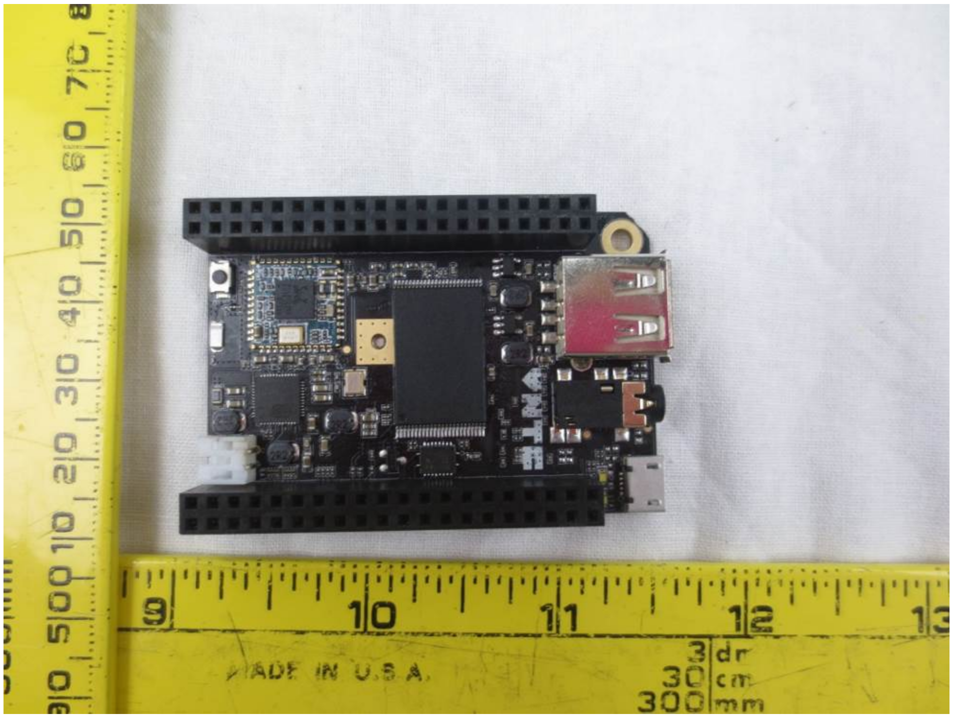
12.2 Radiated Emission below 1 GHz Rear View

12.3 Radiated Emission above 1 GHz Front View

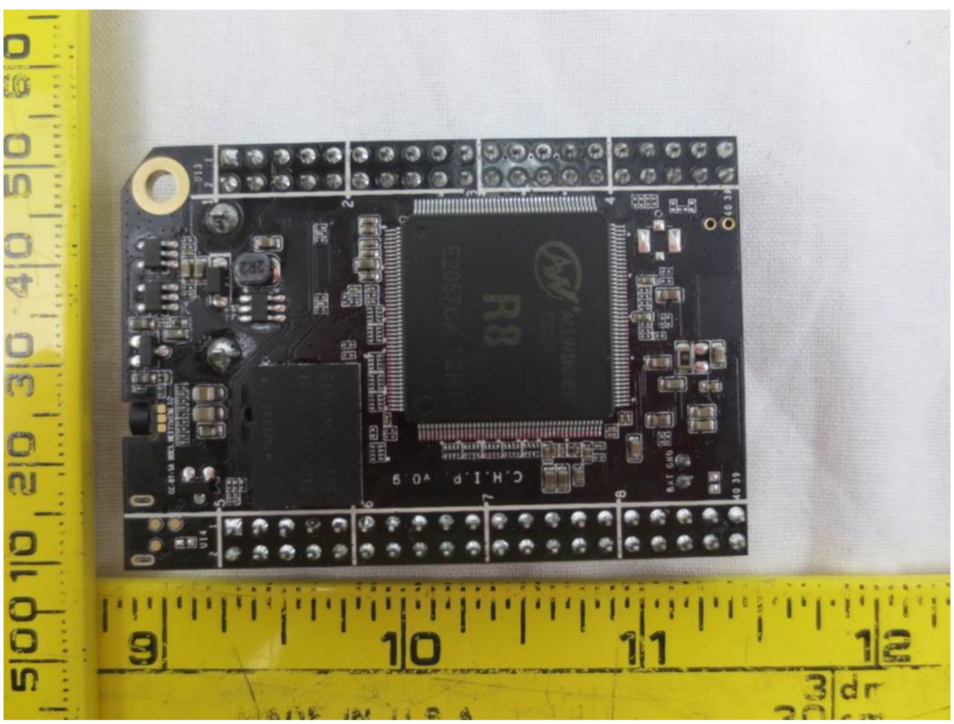
12.4 Radiated Emission above 1 GHz Rear View

13 Exhibit C – EUT Photographs

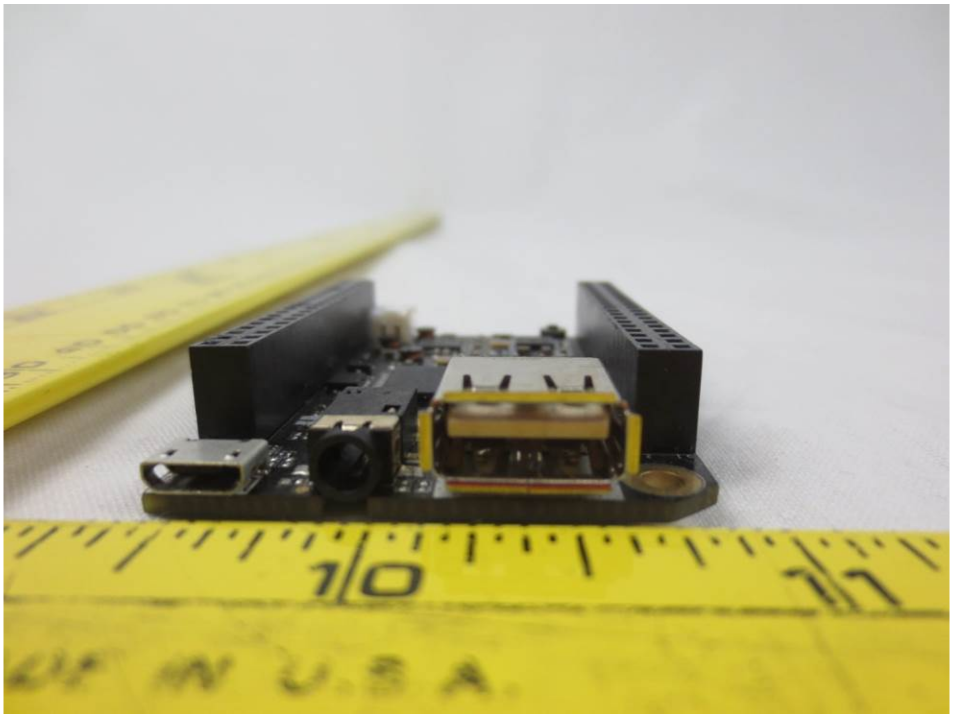
13.1 EUT Photo – Top View



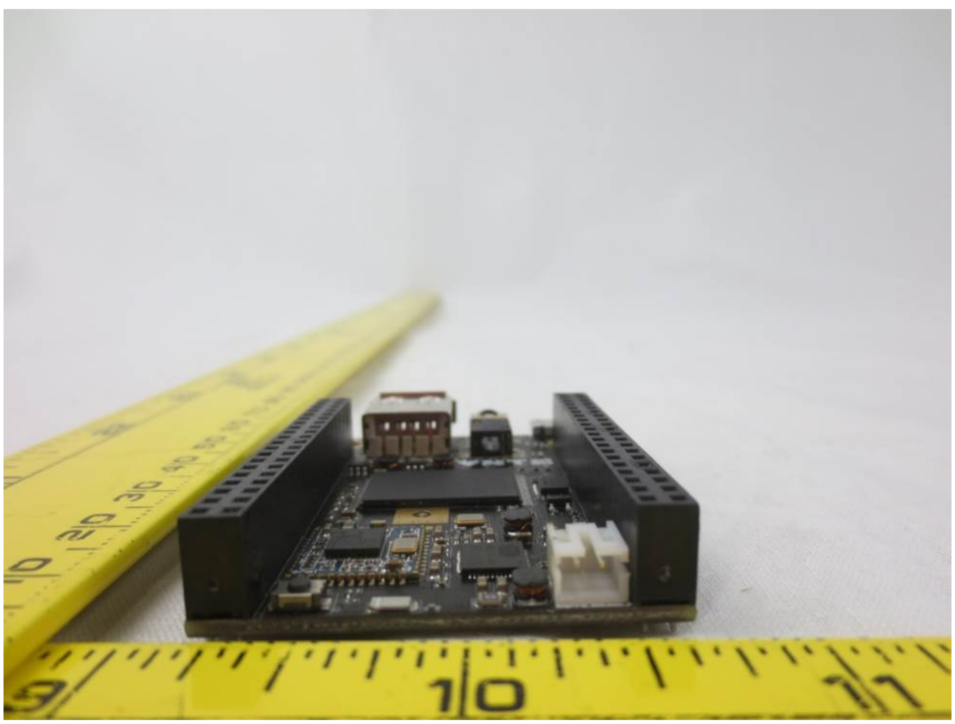
13.2 EUT Photo – Bottom View



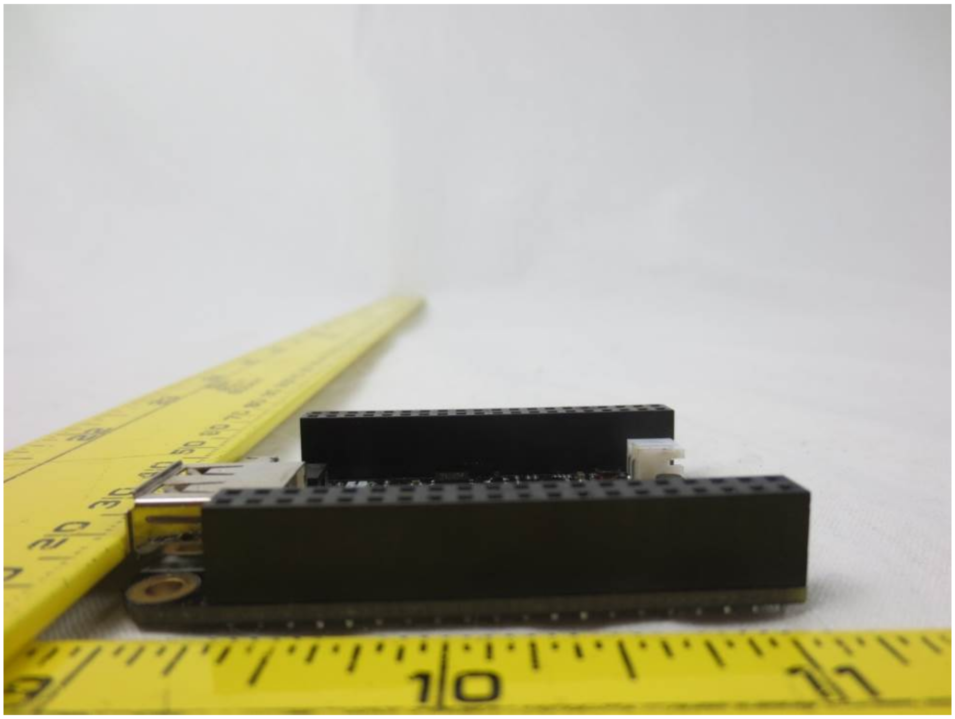
13.3 EUT Photo –Front



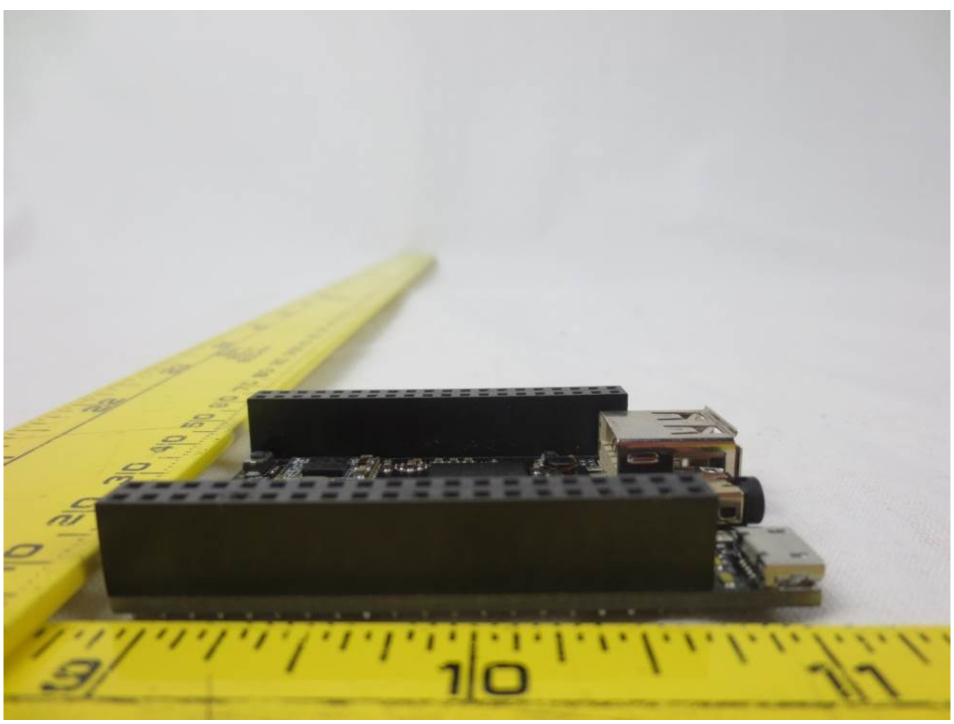
13.4 EUT Photo –Back



13.5 EUT Photo –Right Side



13.6 EUT Photo –Left Side



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