

TEST REPORT

of

FCC Part 15 Subpart C

☒ New Application; ☐ Class I PC; ☐ Class II PC

Product : 10P digital signage player and data collection terminal

Brand: Zunidata

Model: 10PB; 10PX-XX(X=0~9 or A~Z or blank);
10P; 10P-RK; APPC-10DSQ; APPC-10DSQP;
APPC-10DSQPL; MCT-10QDS;
MCT-10QDS-POE; 10P-XX(X=0~9 or A~Z or blank)

Model Difference: Market Segment

FCC ID: Z28-10P

FCC Rule Part: §15.247, Cat: DSS

Applicant: ZUNIDATA SYSTEMS, INC

Address: 4F-7, No.65, Gaotie 7th Rd., Zhubei City,
Hsinchu County, 302, Taiwan

Test Performed by:
International Standards Laboratory

<Lung-Tan LAB>

*Site Registration No.

BSMI: SL2-IN-E-0013; MRA TW1036; TAF: 0997; IC: IC4067B-3;

*Address:

No. 120, Lane 180, Hsin Ho Rd.

Lung-Tan Dist., Tao Yuan City 325, Taiwan

*Tel : 886-3-407-1718; Fax: 886-3-407-1738

Report No.: ISL-16LR032FCDSS

Issue Date :2016/06/08



Test results given in this report apply only to the specific sample(s) tested and are traceable to national or international standard through calibration of the equipment and evaluating measurement uncertainty herein.

This report MUST not be used to claim product endorsement by TAF, NVLAP or any agency of the Government.

This test report shall not be reproduced except in full, without the written approval of International Standards Laboratory.

VERIFICATION OF COMPLIANCE

Applicant: ZUNIDATA SYSTEMS, INC
Product Description: 10P digital signage player and data collection terminal
Brand Name: Zunidata
10PB; 10PX-XX(X=0~9 or A~Z or blank); 10P; 10P-RK;
Model No.: APPC-10DSQ; APPC-10DSQP; APPC-10DSQPL;
MCT-10QDS; MCT-10QDS-POE; 10P-XX(X=0~9 or A~Z or
blank)
Model Difference: Market Segment
FCC ID: Z28-10P
Date of test: 2016/03/02 ~ 2016/06/06
Date of EUT Received: 2016/03/02

We hereby certify that:

All the tests in this report have been performed and recorded in accordance with the standards described above and performed by an independent electromagnetic compatibility consultant, International Standards Laboratory.

The test results contained in this report accurately represent the measurements of the characteristics and the energy generated by sample equipment under test at the time of the test. The sample equipment tested as described in this report is in compliance with the limits of above standards.

Test By:	 _____ Dion Chang / Engineer	Date:	2016/06/08 _____
Prepared By:	 _____ Eva Kao / Technical Supervisor	Date:	2016/06/08 _____
Approved By:	 _____ Vincent Su / Technical Manager	Date:	2016/06/08 _____

Version

Version No.	Date	Description
00	2016/06/08	Initial creation of document

Table of Contents

1. GENERAL INFORMATION	6
1.1. Product Description	6
2.1. Related Submittal(s) / Grant (s)	8
2.2. Test Methodology	8
2.3. Test Facility	8
2.4. Special Accessories	8
2.5. Equipment Modifications	8
2. SYSTEM TEST CONFIGURATION	9
2.1. EUT Configuration	9
2.2. EUT Exercise	9
2.3. Test Procedure	9
2.4. Configuration of Tested System	10
3. SUMMARY OF TEST RESULTS	11
4. DESCRIPTION OF TEST MODES	11
5. AC POWER LINE CONDUCTED EMISSION TEST	12
5.1. Standard Applicable:	12
5.2. Measurement Equipment Used:	12
5.3. EUT Setup:	12
5.4. Measurement Procedure:	13
5.5. Measurement Result:	13
6. PEAK OUTPUT POWER MEASUREMENT	16
6.1. Standard Applicable:	16
6.2. Measurement Equipment Used:	16
6.3. Test Set-up:	16
6.4. Measurement Procedure:	16
6.5. Measurement Result:	17
7. 100KHz BANDWIDTH OF BAND EDGES MEASUREMENT	18
7.1. Standard Applicable:	18
7.2. Measurement Equipment Used:	18
7.3. Test SET-UP:	19
7.4. Measurement Procedure:	20
7.5. Field Strength Calculation	20
7.6. Measurement Result:	20
8. SPURIOUS EMISSION TEST	24
8.1. Standard Applicable:	24
8.2. Measurement Equipment Used:	24
8.3. Test SET-UP:	24
8.4. Measurement Procedure:	25
8.5. Field Strength Calculation	25
8.6. Measurement Result:	25

9. FREQUENCY SEPARATION	32
9.1. Standard Applicable:	32
9.2. Measurement Equipment Used:	32
9.3. Test Set-up:	32
9.4. Measurement Procedure:	32
9.5. Measurement Result:	32
10. NUMBER OF HOPPING FREQUENCY	35
10.1. Standard Applicable:	35
10.2. Measurement Equipment Used:	35
10.3. Test Set-up:	35
10.4. Measurement Procedure:	35
10.5. Measurement Result:	35
11. TIME OF OCCUPANCY (DWELL TIME)	37
11.1. Standard Applicable:	37
11.2. Measurement Equipment Used:	37
11.3. Test Set-up:	37
11.4. Measurement Procedure:	37
11.5. Measurement Result:	38
12. 20dB Bandwidth Bandwidth.....	44
12.1. Standard Applicable:	44
12.2. Measurement Equipment Used:	44
12.3. Test Set-up:	44
12.4. Measurement Procedure:	44
12.5. Measurement Result:	45
13. ANTENNA REQUIREMENT	51
13.1. Standard Applicable:	51
13.2. Antenna Connected Construction:	51

1. GENERAL INFORMATION

1.1. Product Description

General:

Product Name:	10P digital signage player and data collection terminal	
Brand:	Zunidata	
Model:	10PB; 10PX-XX(X=0~9 or A~Z or blank); 10P; 10P-RK; APPC-10DSQ; APPC-10DSQP; APPC-10DSQPL; MCT-10QDS; MCT-10QDS-POE; 10P-XX(X=0~9 or A~Z or blank)	
Model different:	Market Segment	
Power Supply:	12Vdc from AC/DC adapter	
	Adapter:	Model : DP30-24120-2E
USB port	Two provided for data link	
SD slot	One provided	
LAN Port:	One provided	

2.4GHz WLAN: 1TX/1RX

Wi-Fi	Frequency Range (MHz)	Channels	Average Power (dBm)	Modulation Technology
802.11b	2412 – 2462(DTS)	11	11.5 dBm	DSSS
802.11g	2412 – 2462(DTS)	11	10 dBm	OFDM
802.11n	HT20 2412 – 2462(DTS)	11	9 dBm	
Tune-Up Power:		+/- 1.0 dBm		
Modulation type:		CCK, DQPSK, DBPSK for DSSS 256QAM.64QAM. 16QAM, QPSK, BPSK for OFDM		
Antenna Designation:		PIFA Antenna , IPEX type connector, gain : -1.65dBi		

Bluetooth:

Frequency Range:	2402 – 2480MHz	2402 – 2480MHz
Bluetooth Version:	V4.0	V2.1 + EDR (GFSK + $\pi/4$ DQPSK + 8DPSK)
Channel number:	40 channels	79 channels
Modulation type:	Wide band Modulation (GFSK)	Frequency Hopping Spread Spectrum
Transmit Power:	4.72 dBm Peak	3.25 dBm (Peak)
Dwell Time:	N/A	$\leq 0.4s$
Antenna Designation:	IPEX PIFA Antenna, gain : -1.65dBi	

The EUT is compliance with IEEE 802.11 b/g/n, BT2.1 and BT4.0 Standard.

This test report applies for Bluetooth EDR V2.1 transmitter.

Remark: The above DUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.2. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: Z28-10P** filing to comply with Section 15.247 of the FCC Part 15C, Subpart C Rules.

1.3. Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4: 2014. Radiated testing was performed at an antenna to EUT distance 3 meters.

Tested in accordance with FCC Public Notice DA 00-705

1.4. Test Facility

The measurement facilities used to collect the 3m Radiated Emission and AC power line conducted data are located on the address of **International Standards Laboratory** <Lung-Tan LAB> No. 120, Lane 180, Hsin Ho Rd., Lung-Tan Dist., Tao Yuan City 325, Taiwan which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4: 2014, ANSI C63.10: 2013. FCC Registration Number is: 872200; Designation Number is: TW1036, Canada Registration Number: 4067B-3.

1.5. Special Accessories

Not available for this EUT intended for grant.

1.6. Equipment Modifications

Not available for this EUT intended for grant.

2. SYSTEM TEST CONFIGURATION

2.1. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2. EUT Exercise

The EUT (Transmitter) was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements.

2.3. Test Procedure

2.3.1 Conducted Emissions

The EUT is placed on a turn table which is 0.8 m above ground plane. According to the requirements in Section 5 and 7 of ANSI C63.10: 2013. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR 16-1-1 Quasi-Peak and Average detector mode.

2.3.2 Radiated Emissions

The EUT is placed on a turn table which is 0.8 m/1.5m(Frequency above 1GHz) above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter(EUT) was rotated through three orthogonal axes according to the requirements in Section 6 and 11 of ANSI C63.10: 2013.

2.4. Configuration of Tested System

Fig. 2-1 Configuration of Tested System (Fixed channel)

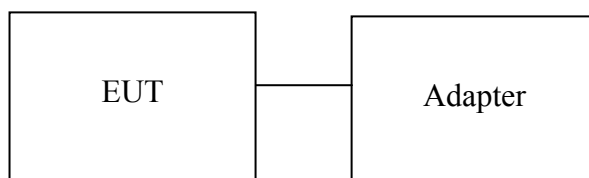


Table 1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/ Type No.	Series No.	Data Cable	Power Cord
1	N/A					

3. SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207(a)	AC Power line Conducted Emission	Compliant
§15.247(b)(1)	Peak Output Power	Compliant
§15.247(d)	100 KHz Bandwidth Of Frequency Band Edges	Compliant
§15.247(c)	TX Spurious Emission	Compliant
§15.247(a)(1)	Frequency Separation	Compliant
§15.247(a)(1)(iii)	Number of hopping frequency	Compliant
§15.247(a)(1)(ii)	Time of Occupancy	Compliant
§15.247(a)(1)	20dB Bandwidth	Compliant
§15.203, §15.247(c)	Antenna Requirement	Compliant

4. DESCRIPTION OF TEST MODES

Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Channel low (2402MHz) 、mid (2441MHz) and high (2480MHz) with each modulation were chosen for full testing.

The worst case BDR mode was reported for Radiated Emission.

5. AC POWER LINE CONDUCTED EMISSION TEST

5.1. Standard Applicable:

According to §15.207, frequency range within 150KHz to 30MHz shall not exceed the Limit table as below.

Frequency range MHz	Limits dB(uV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Note

- 1.The lower limit shall apply at the transition frequencies
- 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

5.2. Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Conduction 04-3 Cable	WOKEN	CFD 300-NL	Conduction 04 -3	07/28/2015	07/27/2016
EMI Receiver 17	Rohde & Schwarz	ESCI 7	100887	09/08/2015	09/07/2016
LISN 18	ROHDE & SCHWARZ	ENV216	101424	02/11/2016	02/10/2017
LISN 19	ROHDE & SCHWARZ	ENV216	101425	03/12/2016	03/11/2017
Test Software	Farad	EZEMC Ver:ISL-03A2	N/A	N/A	N/A

5.3. EUT Setup:

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.4-2009.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

5.4. Measurement Procedure:

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

5.5. Measurement Result:

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

Note: Refer to next page for measurement data and plots.

AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation Mode	Test Date:	2016/03/17
Test By:	Dino		

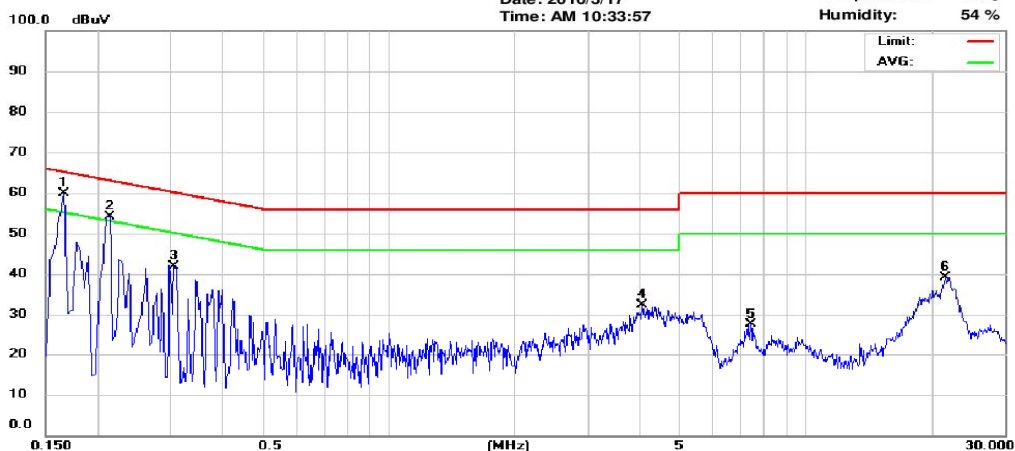


Address: No. 120, Lane 180, Hsin Ho Rd., Lung-Tan Dist.,
Tao Yuan City 325, Taiwan.
Tel: 03-4071718

Conducted Emission Measurement

operator:
Temperature: 26 °C
Humidity: 54 %

Date: 2016/3/17
Time: AM 10:33:57



Site: Conduction 04

Phase: L1

Limit: CISPR22 Class B Conduction(QP)

No.	Frequency (MHz)	QP_R (dBuV)	AVG_R (dBuV)	Correct Factor (dB)	QP Emission (dBuV)	QP Limit (dBuV)	QP Margin (dB)	AVG Emission (dBuV)	AVG Limit (dBuV)	AVG Margin (dB)
1	0.166	49.43	31.50	9.69	59.12	65.16	-6.04	41.19	55.16	-13.97
2	0.214	42.59	25.07	9.69	52.28	63.05	-10.77	34.76	53.05	-18.29
3	0.306	29.60	10.27	9.69	39.29	60.08	-20.79	19.96	50.08	-30.12
4	4.054	17.44	6.63	9.81	27.25	56.00	-28.75	16.44	46.00	-29.56
5	7.370	8.83	0.92	9.89	18.72	60.00	-41.28	10.81	50.00	-39.19
6	21.658	24.27	17.09	10.07	34.34	60.00	-25.66	27.16	50.00	-22.84

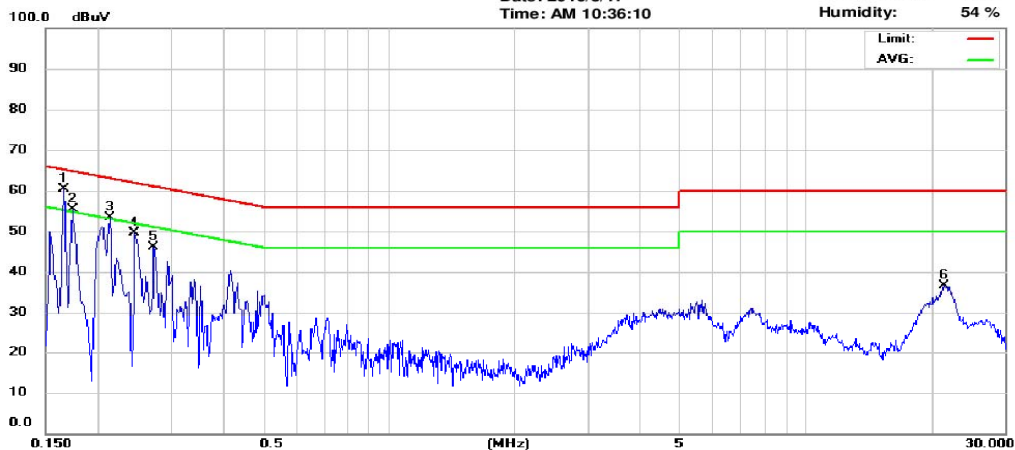


Address: No. 120, Lane 180, Hsin Ho Rd., Lung-Tan Dist.,
Tao Yuan City 325, Taiwan.
Tel: 03-4071718

Conducted Emission Measurement

Date: 2016/3/17
Time: AM 10:36:10

operator:
Temperature: 26 °C
Humidity: 54 %



Site: Conduction 04

Phase: **N**

Limit: CISPR22 Class B Conduction(QP)

No.	Frequency (MHz)	QP_R (dBuV)	AVG_R (dBuV)	Correct Factor (dB)	QP Emission (dBuV)	QP Limit (dBuV)	QP Margin (dB)	AVG Emission (dBuV)	AVG Limit (dBuV)	AVG Margin (dB)
1	0.166	48.93	31.16	9.68	58.61	65.16	-6.55	40.84	55.16	-14.32
2	0.174	47.93	29.93	9.68	57.61	64.77	-7.16	39.61	54.77	-15.16
3	0.214	41.99	25.36	9.68	51.67	63.05	-11.38	35.04	53.05	-18.01
4	0.246	36.78	17.69	9.68	46.46	61.89	-15.43	27.37	51.89	-24.52
5	0.274	28.96	5.95	9.68	38.64	61.00	-22.36	15.63	51.00	-35.37
6	21.510	22.11	15.30	10.19	32.30	60.00	-27.70	25.49	50.00	-24.51

6. PEAK OUTPUT POWER MEASUREMENT

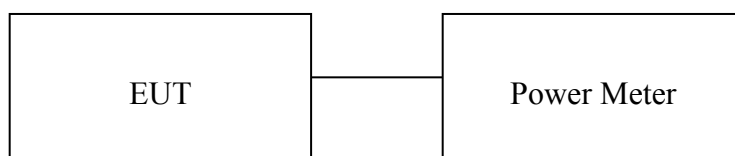
6.1. Standard Applicable:

According to §15.247(b)(1), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1Watt. For all other frequency hopping systems in the 2400 – 2483.5MHz band: 0.125 Watts.

6.2. Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Meter 05	Anritsu	ML2495A	1116010	07/29/2015	07/28/2016
Power Sensor 05	Anritsu	MA2411B	34NKF50	07/29/2015	07/28/2016
Power Sensor 06	DARE	RPR3006W	13I00030SNO33	11/03/2015	11/02/2016
Power Sensor 07	DARE	RPR3006W	13I00030SNO34	11/03/2015	11/02/2016
Temperature Chamber	KSON	THS-B4H100	2287	06/05/2015	06/04/2016
DC Power supply	ABM	8185D	N/A	09/05/2015	09/04/2016
AC Power supply	EXTECH	CFC105W	NA	12/26/2015	12/25/2016
Attenuator	Woken	Watt-65m3502	11051601	NA	NA
Splitter	MCLI	PS4-199	12465	12/26/2015	12/25/2017
Spectrum analyzer	Agilent	N9030A	MY51360021	10/02/2015	10/01/2016
Test Software	DARE	Radimation Ver:2013.1.23	NA	N/A	N/A

6.3. .Test Set-up:



6.4. Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter or spectrum. (Channel power function, RBW, VBW = 1MHz)
3. Record the max. reading.
4. Repeat above procedures until all frequency measured were complete.

6.5. Measurement Result:

BDR Mode

Frequency (MHz)	Peak Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
Low	3.21	0.00	3.21	0.00209	1
Mid	3.25	0.00	3.25	0.00211	1
High	3.16	0.00	3.16	0.00207	1

EDR 2M Mode

Frequency (MHz)	Peak Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
Low	2.81	0.00	2.81	0.00191	0.125
Mid	2.65	0.00	2.65	0.00184	0.125
High	2.77	0.00	2.77	0.00189	0.125

EDR 3M Mode

Frequency (MHz)	Peak Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
Low	-3.18	0.00	-3.18	0.00048	0.125
Mid	-2.96	0.00	-2.96	0.00051	0.125
High	-3.14	0.00	-3.14	0.00049	0.125

Offset: 0.8dB

7. 100KHz BANDWIDTH OF BAND EDGES MEASUREMENT

7.1. Standard Applicable:

According to §15.247(d), in any 100 KHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100KHz bandwidth within the band that contains the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

7.2. Measurement Equipment Used:

7.2.1. Conducted Emission at antenna port:

Refer to section 6.2 for details.

7.2.2. Radiated emission:

Chamber 14(966)					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer 21(26.5GHz)	Agilent	N9010A	MY49060537	07/30/2015	07/29/2016
Spectrum Analyzer 20(6.5GHz)	Agilent	E4443A	MY48250315	05/20/2016	05/19/2017
Spectrum Analyzer 22(43GHz)	R&S	FSU43	100143	05/22/2016	05/21/2017
Loop Antenna9K-30M	A.H.SYSTEM	SAS-564	294	06/17/2015	06/16/2017
Bilog Antenna30-1G	Schaffner	CBL 6112D	37873	06/16/2015	06/15/2016
Horn antenna1-18G	ETS	3117	00066665	11/30/2015	11/29/2016
Horn antenna26-40G(05)	Com-power	AH-640	100A	01/21/2015	01/20/2017
Horn antenna18-26G(04)	Com-power	AH-826	081001	07/24/2015	07/23/2017
Preamplifier9-1000M	HP	8447D	NA	03/09/2016	03/08/2017
Preamplifier1-18G	MITEQ	AFS44-001018 00-25-10P-44	1329256	07/28/2015	07/27/2016
Preamplifier1-26G	EM	EM01M26G	NA	03/10/2016	03/09/2017
Preamplifier26-40G	MITEQ	JS-26004000-2 7-5A	818471	07/23/2015	07/22/2017
Cable1-18G	HUBER SUHNER	Sucoflex 106	NA	11/25/2015	11/24/2016
Cable UP to 1G	HUBER SUHNER	RG 214/U	NA	10/02/2015	10/01/2016
SUCOFLEX 1GHz~40GHz cable	HUBER SUHNER	Sucoflex 102	27963/2&3742 1/2	11/03/2015	11/02/2017
2.4G Filter	Micro-Tronics	Brm50702	76	12/26/2015	12/25/2016
Test Software	Audix	E3 Ver:6.12023	N/A	N/A	N/A
Test Software	Farad	EZEMC Ver:ISL-03A2	N/A	N/A	N/A

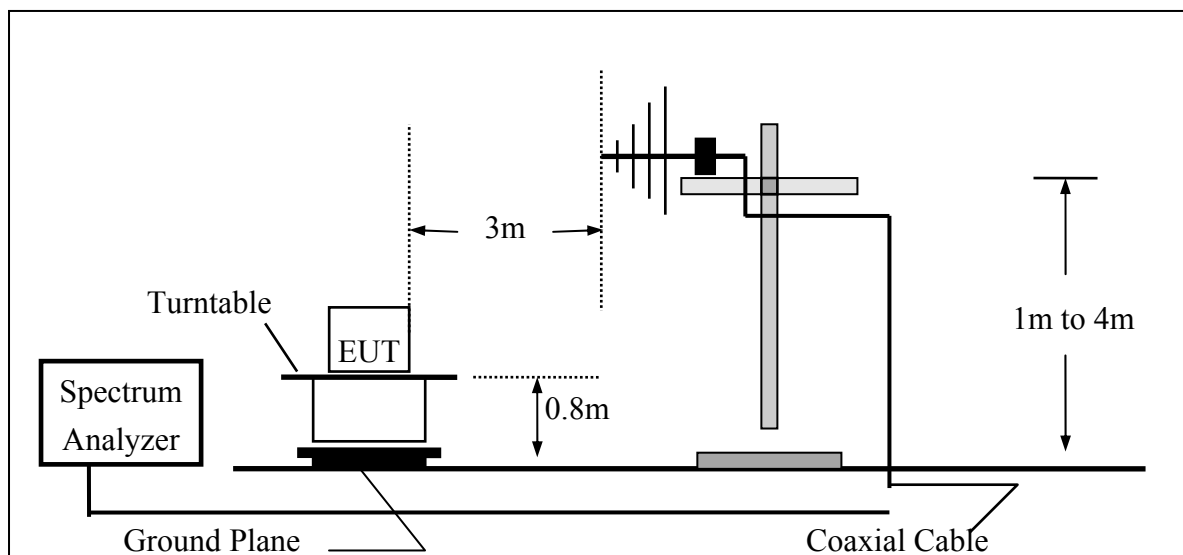
7.3. Test SET-UP:

7.3.1. Conducted Emission at antenna port:

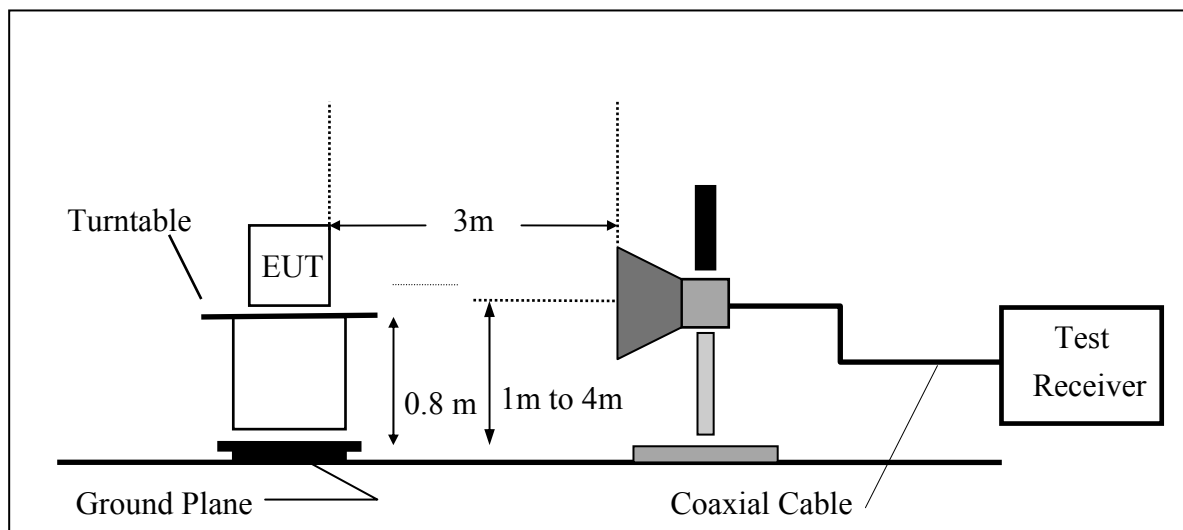
Refer to section 6.3 for details.

7.3.2. Radiated emission:

(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(B) Radiated Emission Test Set-UP Frequency Over 1 GHz



7.4. Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW, VBW=100KHz, Span=25MHz, Sweep = auto
5. Mark Peak, 2.390GHz and 2.4835GHz and record the max. level.
6. Repeat above procedures until all frequency measured were complete.

7.5. Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

7.6. Measurement Result:

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

Radiated Emission: (BDR mode)

Operation Mode TX CH Low
Fundamental Frequency 2402 MHz
Temperature 25 °C

Test Date 2016/03/14
Test By Dino
Humidity 60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	2390.00	50.96	-10.74	40.22	74.00	-33.78	Peak	VERTICAL
2	2400.00	50.98	-10.71	40.27	55.84	-15.57	Peak	VERTICAL
3	2402.16	86.54	-10.70	75.84	F	---	Peak	VERTICAL
1	2390.00	50.85	-10.74	40.11	74.00	-33.89	Peak	HORIZONTAL
2	2400.00	55.50	-10.71	44.79	59.06	-14.27	Peak	HORIZONTAL
3	2401.88	89.76	-10.70	79.06	F	---	Peak	HORIZONTAL

Operation Mode TX CH High
Fundamental Frequency 2480 MHz
Temperature 25 °C

Test Date 2016/03/14
Test By Dino
Humidity 60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	2483.50	50.29	-10.40	39.89	74.00	-34.11	Peak	VERTICAL
1	2483.50	50.77	-10.40	40.37	74.00	-33.63	Peak	HORIZONTAL

Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 "F" denotes fundamental frequency; "H" denotes harmonics frequency. "S" denotes spurious frequency.
- 4 Measurement of data within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 6 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

Note: "F" denotes fundamental frequency

Radiated Emission (EDR 2M mode):

Operation Mode TX CH Low
Fundamental Frequency 2402 MHz
Temperature 25 °C

Test Date 2016/03/14
Test By Dino
Humidity 60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	2390.00	51.72	-10.74	40.98	74.00	-33.02	Peak	VERTICAL
2	2400.00	54.48	-10.71	43.77	55.11	-11.34	Peak	VERTICAL
3	2401.88	85.81	-10.70	75.11	F	---	Peak	VERTICAL
1	2390.00	50.84	-10.74	40.10	74.00	-33.90	Peak	HORIZONTAL
2	2400.00	57.48	-10.71	46.77	58.43	-11.66	Peak	HORIZONTAL
3	2401.88	89.13	-10.70	78.43	F	---	Peak	HORIZONTAL

Operation Mode TX CH High
Fundamental Frequency 2480 MHz
Temperature 25 °C

Test Date 2016/03/14
Test By Dino
Humidity 60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	2483.50	50.32	-10.40	39.92	74.00	-34.08	Peak	VERTICAL
1	2483.50	50.54	-10.40	40.14	74.00	-33.86	Peak	HORIZONTAL

Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 “F” denotes fundamental frequency; “H” denotes harmonics frequency. “S” denotes spurious frequency.
- 4 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 6 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

Note: “F” denotes fundamental frequency

Radiated Emission (EDR 3M mode):

Operation Mode TX CH Low
Fundamental Frequency 2402 MHz
Temperature 25 °C

Test Date 2016/03/14
Test By Dino
Humidity 60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	2390.00	50.60	-10.74	39.86	74.00	-34.14	Peak	VERTICAL
2	2400.00	53.56	-10.71	42.85	54.51	-11.66	Peak	VERTICAL
3	2401.98	85.21	-10.70	74.51	F	---	Peak	VERTICAL
1	2390.00	50.40	-10.74	39.66	74.00	-34.34	Peak	HORIZONTAL
2	2400.00	57.57	-10.71	46.86	58.04	-11.18	Peak	HORIZONTAL
3	2402.26	88.74	-10.70	78.04	F	---	Peak	HORIZONTAL

Operation Mode TX CH High
Fundamental Frequency 2480 MHz
Temperature 25 °C

Test Date 2016/03/14
Test By Dino
Humidity 60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	2483.50	50.52	-10.40	40.12	74.00	-33.88	Peak	VERTICAL
1	2483.50	50.55	-10.40	40.15	74.00	-33.85	Peak	HORIZONTAL

Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 “F” denotes fundamental frequency; “H” denotes harmonics frequency. “S” denotes spurious frequency.
- 4 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 6 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

Note: “F” denotes fundamental frequency

8. SPURIOUS EMISSION TEST

8.1. Standard Applicable:

According to §15.247(d), all other emissions outside these bands shall not exceed the general radiated emission limits specified in §15.209(a). And according to §15.33(a)(1), for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

8.2. Measurement Equipment Used:

8.2.1. Conducted Emission at antenna port:

Refer to section 6.2 for details.

8.2.2. Radiated emission:

Refer to section 7.2 for details.

8.3. Test SET-UP:

8.3.1. Conducted Emission at antenna port:

Refer to section 6.3 for details.

8.3.2. Radiated emission:

Refer to section 7.3 for details.

8.4. Measurement Procedure:

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
4. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. Repeat above procedures until all frequency measured were complete.

8.5. Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

8.6. Measurement Result:

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

Radiated Spurious Emission Measurement Result: (below 1GHz) (Worst case: BDR Mode)

Operation Mode TX CH Low
Fundamental Frequency 2402MHz
Temperature 25 °C

Test Date 2016/03/14
Test By Dino
Humidity 60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	95.96	56.48	-17.75	38.73	43.50	-4.77	Peak	VERTICAL
2	192.96	56.00	-14.56	41.44	43.50	-2.06	Peak	VERTICAL
3	338.46	48.91	-10.27	38.64	46.00	-7.36	Peak	VERTICAL
4	480.08	37.59	-7.59	30.00	46.00	-16.00	Peak	VERTICAL
5	832.19	35.91	-1.65	34.26	46.00	-11.74	Peak	VERTICAL
6	900.09	45.25	-0.50	44.75	46.00	-1.25	Peak	VERTICAL
1	95.96	56.48	-17.75	38.73	43.50	-4.77	Peak	HORIZONTAL
2	224.00	56.31	-14.07	42.24	46.00	-3.76	Peak	HORIZONTAL
3	338.46	52.66	-10.27	42.39	46.00	-3.61	Peak	HORIZONTAL
4	576.11	37.75	-5.94	31.81	46.00	-14.19	Peak	HORIZONTAL
5	832.19	40.21	-1.65	38.56	46.00	-7.44	Peak	HORIZONTAL
6	900.09	41.69	-0.50	41.19	46.00	-4.81	Peak	HORIZONTAL

Remark:

- 1 No further spurious emissions detected from the lowest internal frequency and 30MHz.
- 2 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 3 Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak / QP detector mode.
- 4 Measurement result within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz, VBW=300KHz.

Radiated Spurious Emission Measurement Result (below 1GHz)

Operation Mode TX CH Mid
Fundamental Frequency 2441MHz
Temperature 25 °C

Test Date 2016/03/14
Test By Dino
Humidity 60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	95.96	57.38	-17.75	39.63	43.50	-3.87	Peak	VERTICAL
2	127.00	55.14	-13.84	41.30	43.50	-2.20	Peak	VERTICAL
3	338.46	48.62	-10.27	38.35	46.00	-7.65	Peak	VERTICAL
4	576.11	40.33	-5.94	34.39	46.00	-11.61	Peak	VERTICAL
5	832.19	37.53	-1.65	35.88	46.00	-10.12	Peak	VERTICAL
6	900.09	45.68	-0.50	45.18	46.00	-0.82	Peak	VERTICAL
1	128.94	53.61	-13.65	39.96	43.50	-3.54	Peak	HORIZONTAL
2	191.99	51.76	-14.54	37.22	43.50	-6.28	Peak	HORIZONTAL
3	338.46	52.74	-10.27	42.47	46.00	-3.53	Peak	HORIZONTAL
4	576.11	43.47	-5.94	37.53	46.00	-8.47	Peak	HORIZONTAL
5	832.19	42.80	-1.65	41.15	46.00	-4.85	Peak	HORIZONTAL
6	900.09	41.57	-0.50	41.07	46.00	-4.93	Peak	HORIZONTAL

Remark:

- 1 No further spurious emissions detected from the lowest internal frequency and 30MHz.
- 2 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 3 Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak / QP detector mode.
- 4 Measurement result within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz, VBW=300KHz.

Radiated Spurious Emission Measurement Result (below 1GHz)

Operation Mode TX CH High
Fundamental Frequency 2480MHz
Temperature 25 °C

Test Date 2016/03/14
Test By Dino
Humidity 60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	143.49	54.11	-12.30	41.81	43.50	-1.69	Peak	VERTICAL
2	191.99	54.68	-14.54	40.14	43.50	-3.36	Peak	VERTICAL
3	338.46	49.07	-10.27	38.80	46.00	-7.20	Peak	VERTICAL
4	576.11	40.07	-5.94	34.13	46.00	-11.87	Peak	VERTICAL
5	832.19	38.70	-1.65	37.05	46.00	-8.95	Peak	VERTICAL
6	900.09	43.17	-0.50	42.67	46.00	-3.33	Peak	VERTICAL
1	135.73	53.55	-12.94	40.61	43.50	-2.89	Peak	HORIZONTAL
2	176.47	54.12	-13.22	40.90	43.50	-2.60	Peak	HORIZONTAL
3	338.46	52.84	-10.27	42.57	46.00	-3.43	Peak	HORIZONTAL
4	600.36	37.40	-5.39	32.01	46.00	-13.99	Peak	HORIZONTAL
5	832.19	41.97	-1.65	40.32	46.00	-5.68	Peak	HORIZONTAL
6	900.09	41.18	-0.50	40.68	46.00	-5.32	Peak	HORIZONTAL

Remark:

- 1 No further spurious emissions detected from the lowest internal frequency and 30MHz.
- 2 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 3 Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak / QP detector mode.
- 4 Measurement result within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz, VBW=300KHz.

Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode TX CH Low
Fundamental Frequency 2402 MHz
Temperature 25 °C

Test Date 2016/03/14
Test By Dino
Humidity 60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	2099.00	48.91	-11.81	37.10	74.00	-36.90	Peak	VERTICAL
2	4804.00	35.87	-3.29	32.58	74.00	-41.42	Peak	VERTICAL
1	1497.00	50.72	-14.83	35.89	74.00	-38.11	Peak	HORIZONTAL
2	4804.00	35.86	-3.29	32.57	74.00	-41.43	Peak	HORIZONTAL

Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 “F” denotes fundamental frequency; “H” denotes harmonics frequency. “S” denotes spurious frequency.
- 4 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 6 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode	TX CH Mid	Test Date	2016/03/14
Fundamental Frequency	2441 MHz	Test By	Dino
Temperature	25 °C	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	2099.00	49.34	-11.81	37.53	74.00	-36.47	Peak	VERTICAL
2	4882.00	35.19	-3.11	32.08	74.00	-41.92	Peak	VERTICAL
1	1504.00	51.61	-14.81	36.80	74.00	-37.20	Peak	HORIZONTAL
2	4882.00	34.98	-3.11	31.87	74.00	-42.13	Peak	HORIZONTAL

Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 “F” denotes fundamental frequency; “H” denotes harmonics frequency. “S” denotes spurious frequency.
- 4 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 6 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode TX CH High
Fundamental Frequency 2480 MHz
Temperature 25 °C

Test Date 2016/03/14
Test By Dino
Humidity 60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	1497.00	51.19	-14.83	36.36	74.00	-37.64	Peak	VERTICAL
2	4960.00	34.81	-2.94	31.87	74.00	-42.13	Peak	VERTICAL
1	1504.00	49.51	-14.81	34.70	74.00	-39.30	Peak	HORIZONTAL
2	4960.00	34.39	-2.94	31.45	74.00	-42.55	Peak	HORIZONTAL

Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 “F” denotes fundamental frequency; “H” denotes harmonics frequency. “S” denotes spurious frequency.
- 4 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 6 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

9. FREQUENCY SEPARATION

9.1. Standard Applicable:

According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the 20dB bandwidth of the hopping channel, whichever is greater.

According to RSS 210 issue 8, A8.1(b), frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

9.2. Measurement Equipment Used:

Refer to section 6.2 for details.

9.3. Test Set-up:

Refer to section 6.3 for details.

9.4. Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = middle of hopping channel .
4. Set the spectrum analyzer as RBW,VBW=100KHz, Adjust Span to 3.0 MHz, Sweep = auto.
5. Max hold. Mark 3 Peaks of hopping channel and record the 3 peaks frequency.

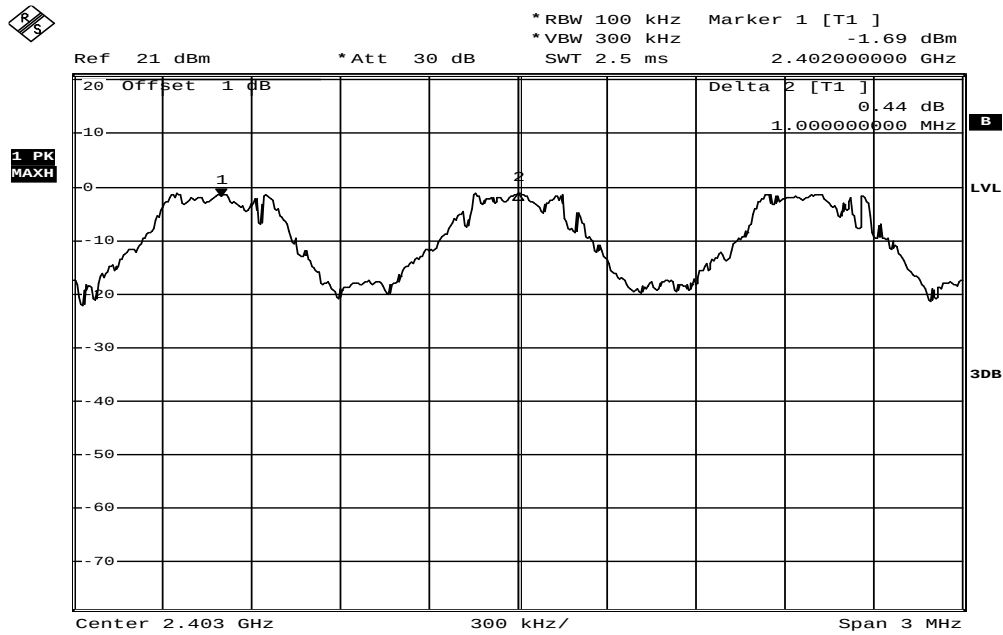
9.5. Measurement Result:

Channel separation (MHz)	Limit	Result
1	$\geq 25\text{KHz}$ or 2/3 times 20dB bandwidth	PASS

Note: Refer to next page for plots.

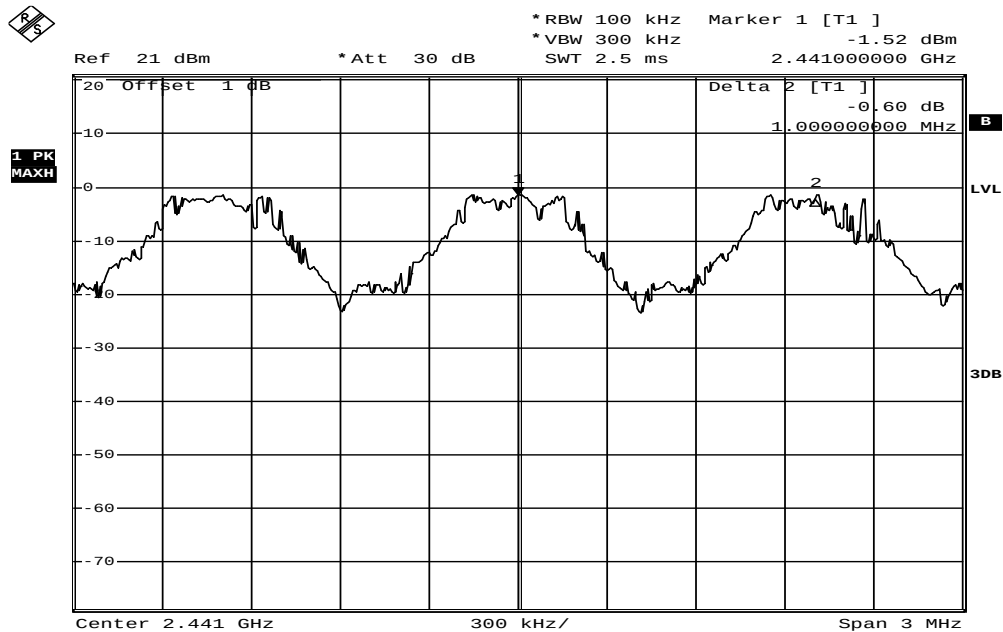
Frequency Separation Test Data

Low



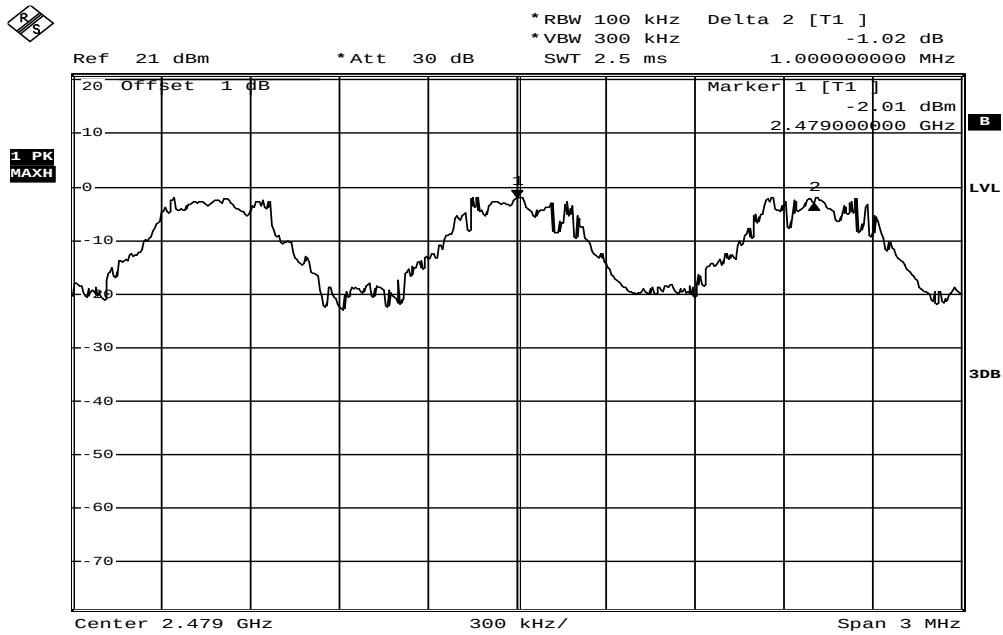
Date: 15.MAR.2016 13:21:26

Mid



Date: 15.MAR.2016 13:24:29

High



Date: 15.MAR.2016 13:27:23

10. NUMBER OF HOPPING FREQUENCY

10.1. Standard Applicable:

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 15 hopping frequencies.

10.2. Measurement Equipment Used:

Refer to section 6.2 for details.

10.3. Test Set-up:

Refer to section 6.3 for details.

10.4. Measurement Procedure:

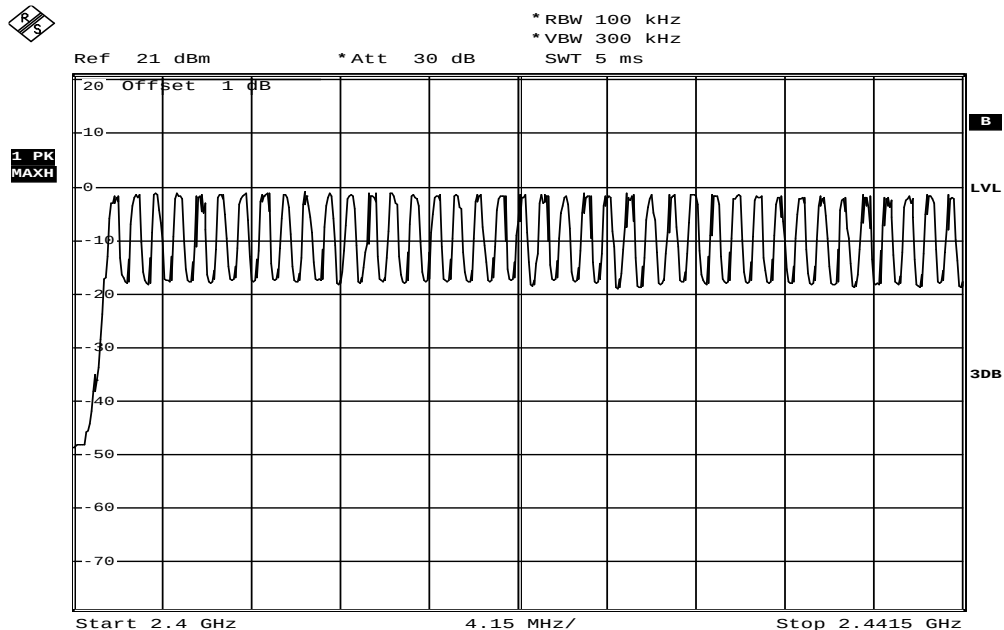
1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set spectrum analyzer Start=2400MHz, Stop = 2441MHz and Start=2441MHz, Stop = 2483.5MHz, Sweep = auto.
4. Set the spectrum analyzer as RBW=300KHz, VBW=1MHz
5. Max hold, view and count how many channel in the band.

10.5. Measurement Result:

Test Result : 79 Channel > 15 Channel

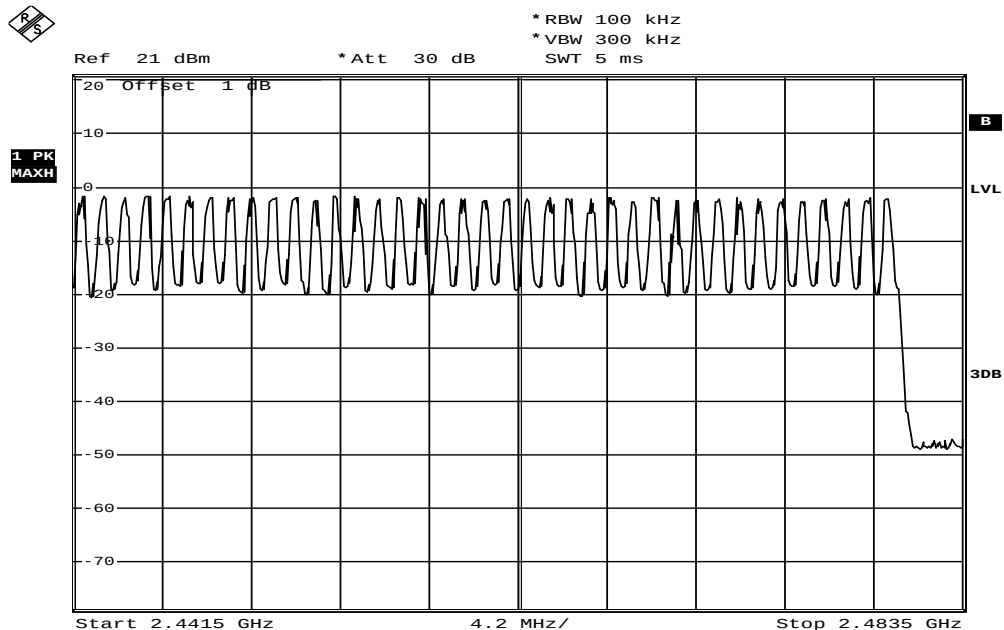
Note: Refer to next page for plots.

Channel Number 2.4 GHz – 2.441GHz



Date: 15.MAR.2016 13:34:22

2.441 GHz – 2.4835GHz



Date: 15.MAR.2016 13:37:27

11. TIME OF OCCUPANCY (DWELL TIME)

11.1. Standard Applicable:

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz. The average time of occupancy on any frequency shall not greater than 0.4 s within period of 0.4 seconds multiplied by the number of hopping channel employed.

11.2. Measurement Equipment Used:

Refer to section 6.2 for details.

11.3. Test Set-up:

Refer to section 6.3 for details.

11.4. Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW / VBW = 1MHz, Span = 0Hz , Adjust Sweep = 2.5ms.
5. Repeat above procedures until all frequency measured were complete.

11.5. Measurement Result:

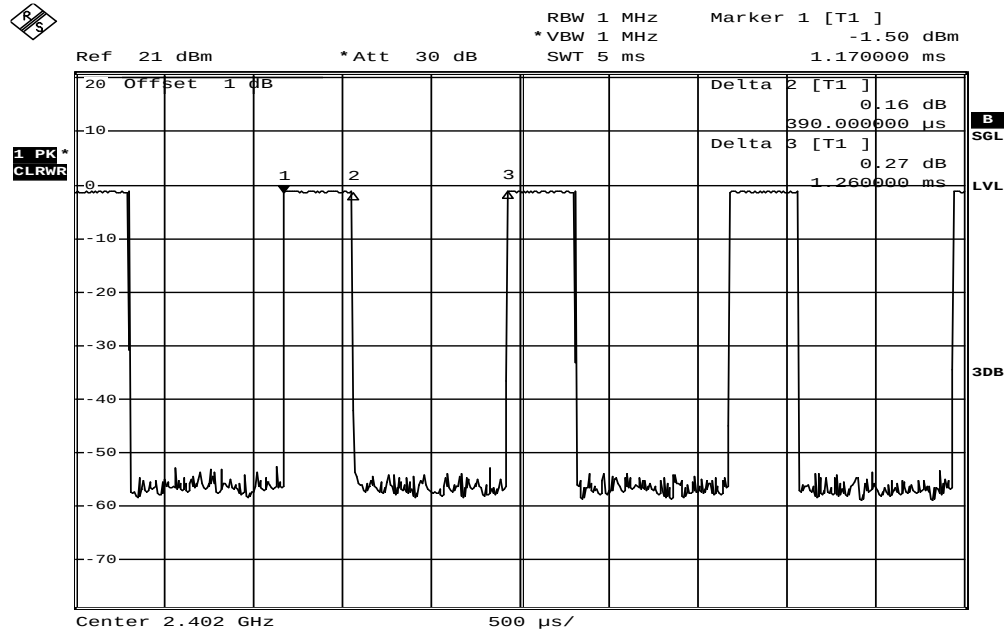
A period time = 0.4 (ms) * 79 = 31.6 (s)

CH Low	DH1 time slot	=	0.390 (ms)	*	(1600/2/79)	*	31.6 =	124.80	(ms)
	DH3 time slot	=	1.640 (ms)	*	(1600/4/79)	*	31.6 =	262.40	(ms)
	DH5 time slot	=	2.880 (ms)	*	(1600/6/79)	*	31.6 =	307.20	(ms)
CH Mid	DH1 time slot	=	0.390 (ms)	*	(1600/2/79)	*	31.6 =	124.80	(ms)
	DH3 time slot	=	1.654 (ms)	*	(1600/4/79)	*	31.6 =	264.64	(ms)
	DH5 time slot	=	2.900 (ms)	*	(1600/6/79)	*	31.6 =	309.33	(ms)
CH High	DH1 time slot	=	0.380 (ms)	*	(1600/2/79)	*	31.6 =	121.60	(ms)
	DH3 time slot	=	1.640 (ms)	*	(1600/4/79)	*	31.6 =	262.40	(ms)
	DH5 time slot	=	2.900 (ms)	*	(1600/6/79)	*	31.6 =	309.33	(ms)

Note: Refer to next page for plots.

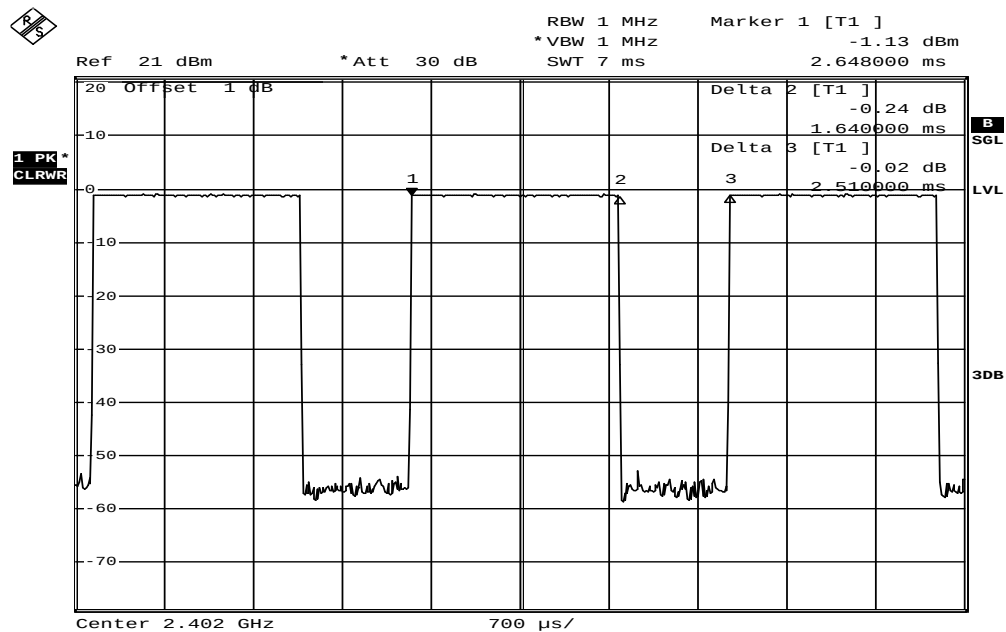
Low Channel

DH1



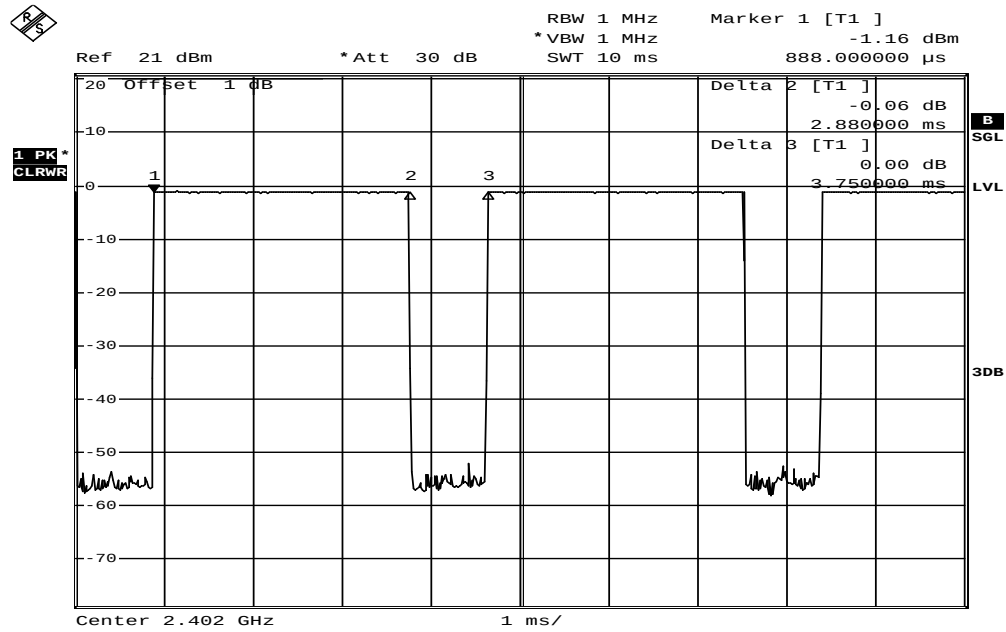
Date: 15.MAR.2016 13:40:29

DH3



Date: 15.MAR.2016 13:43:28

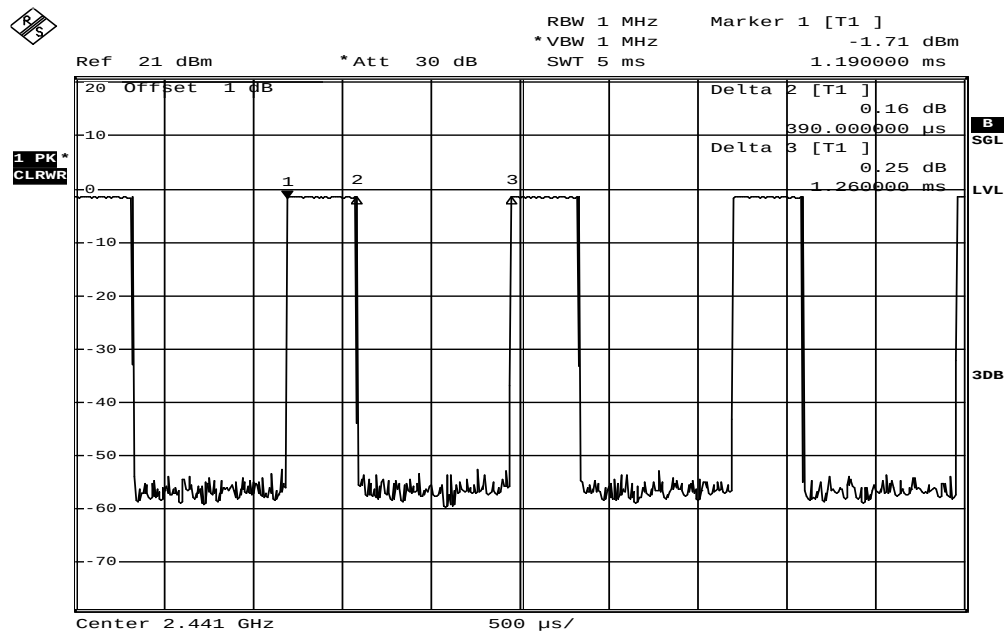
DH5



Date: 15.MAR.2016 13:43:57

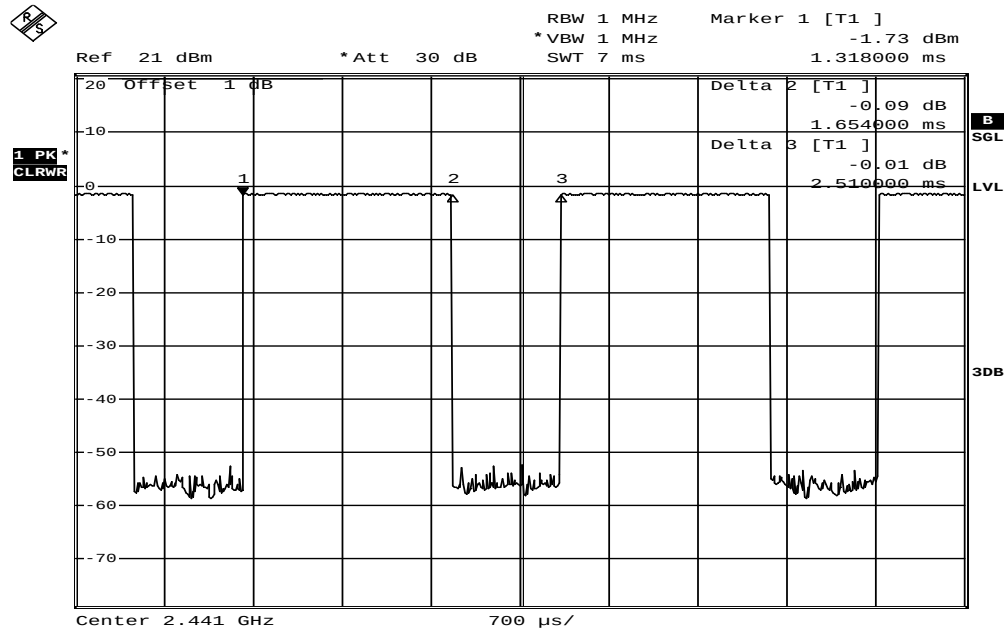
Mid Channel

DH1



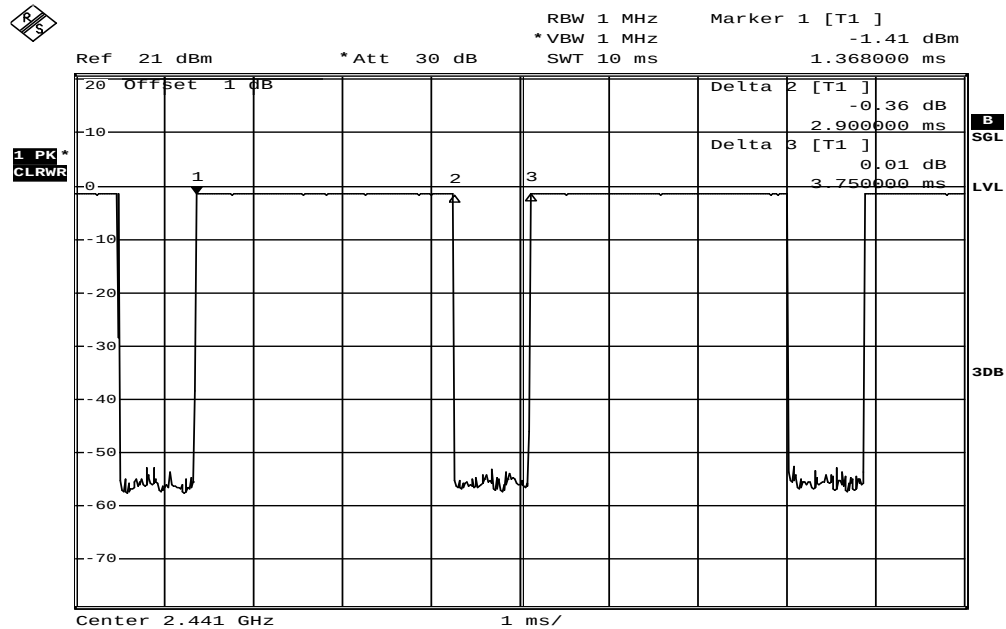
Date: 15.MAR.2016 13:40:58

DH3



Date: 15.MAR.2016 13:42:56

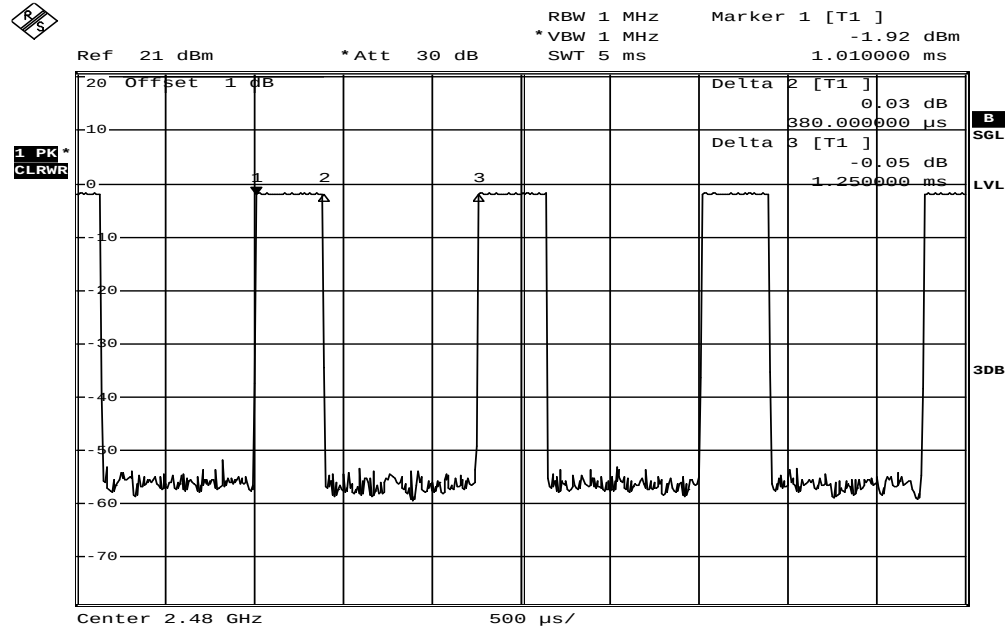
DH5



Date: 15.MAR.2016 13:44:31

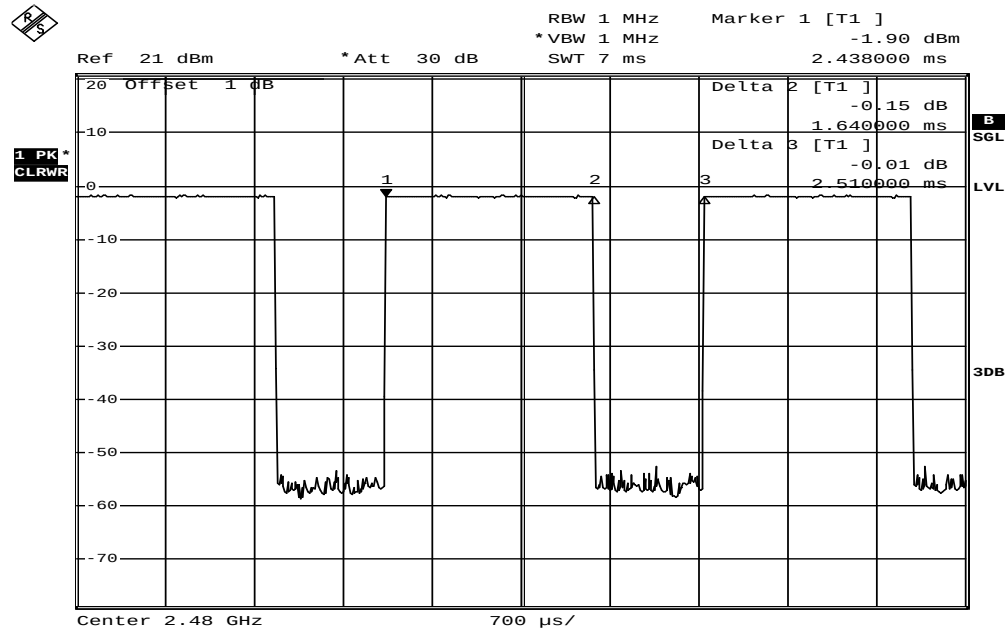
High Channel

DH1



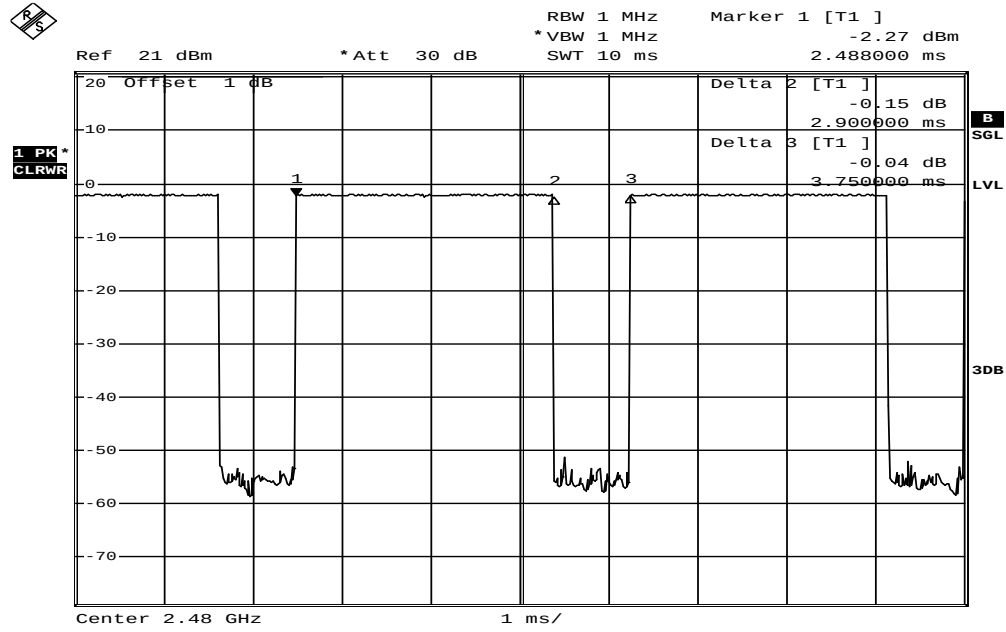
Date: 15.MAR.2016 13:41:40

DH3



Date: 15.MAR.2016 13:42:23

DH5



Date: 15.MAR.2016 13:44:59

12. 20dB Bandwidth Bandwidth

12.1. Standard Applicable:

According to §15.247(a)(1), for frequency hopping systems operating in the 2400MHz-2483.5 MHz no limit for 20dB bandwidth.

12.2. Measurement Equipment Used:

Refer to section 6.2 for details.

12.3. Test Set-up:

Refer to section 6.3 for details.

12.4. Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW=10KHz (1 % of Bandwidth.), Span= 3MHz, Sweep=auto
4. Mark the peak frequency and -20dB (upper and lower) frequency.
5. Repeat above procedures until all frequency measured were complete.

12.5. Measurement Result:

BDR Mode

CH	20dB Bandwidth (MHz)
Low	0.762
Mid	0.762
High	0.762

EDR 2M Mode

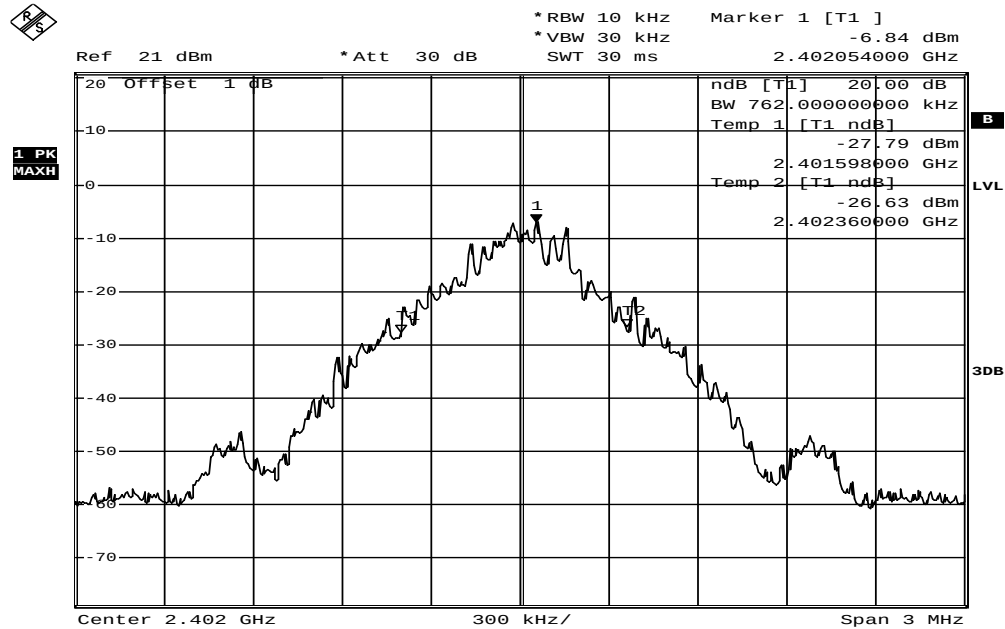
CH	20dB Bandwidth (MHz)	2/3* 20dB Bandwidth (MHz)
Lower	1.29	0.860
Mid	1.284	0.856
Higher	1.284	0.856

EDR 3M Mode

CH	20dB Bandwidth (MHz)	2/3* 20dB Bandwidth (MHz)
Lower	1.224	0.816
Mid	1.224	0.816
Higher	1.26	0.840

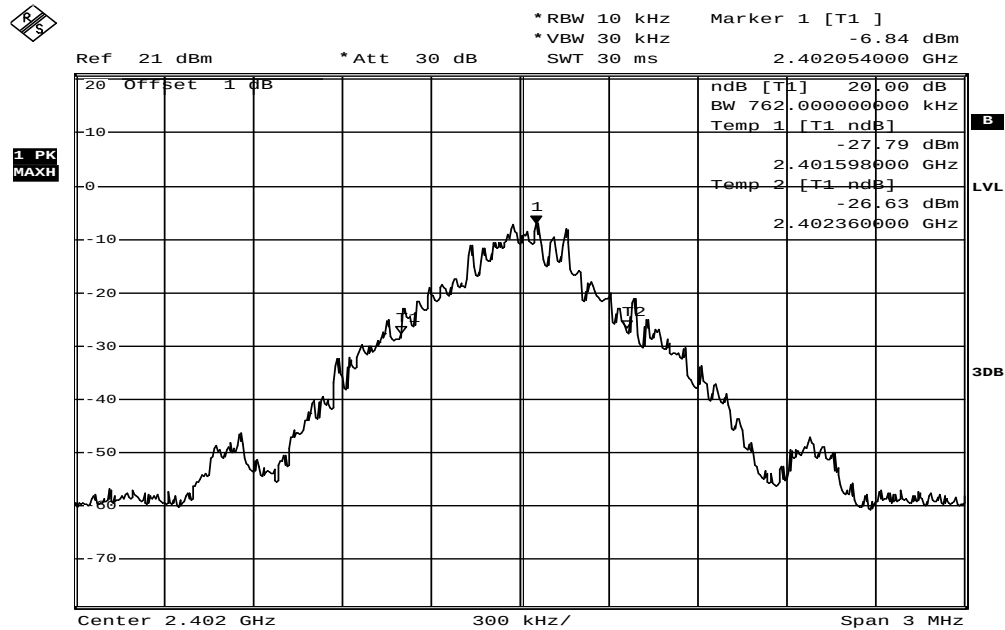
Note: Refer to next page for plots.

BDR Mode 20dB Bandwidth Test Data CH-Low



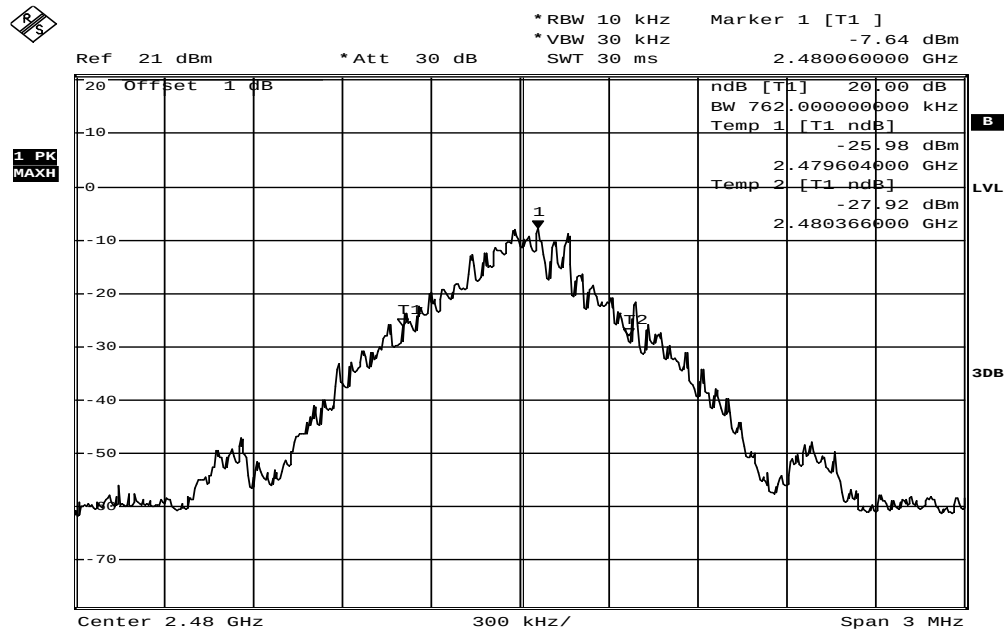
Date: 15.MAR.2016 13:09:15

20dB Bandwidth Test Data CH-Mid



Date: 15.MAR.2016 13:09:15

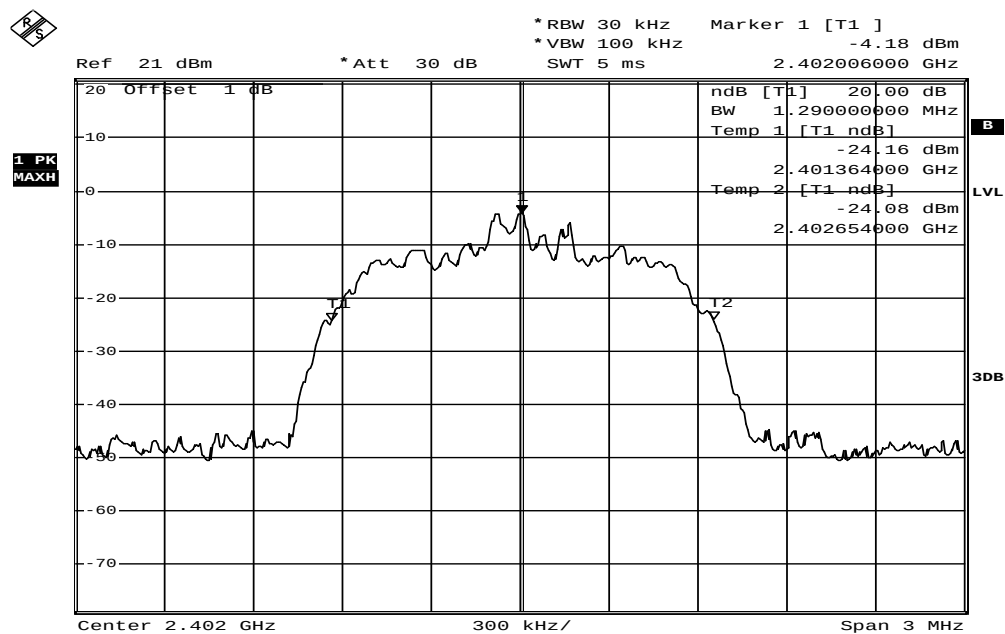
20dB Bandwidth Test Data CH-High



Date: 15.MAR.2016 13:10:29

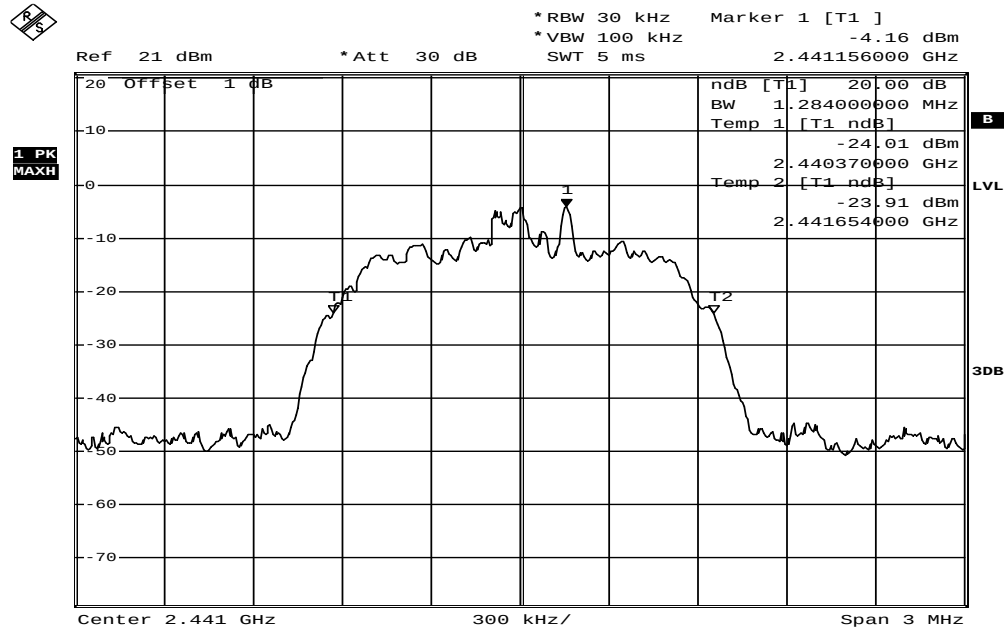
EDR 2M Mode

20dB Bandwidth Test Data CH-Low



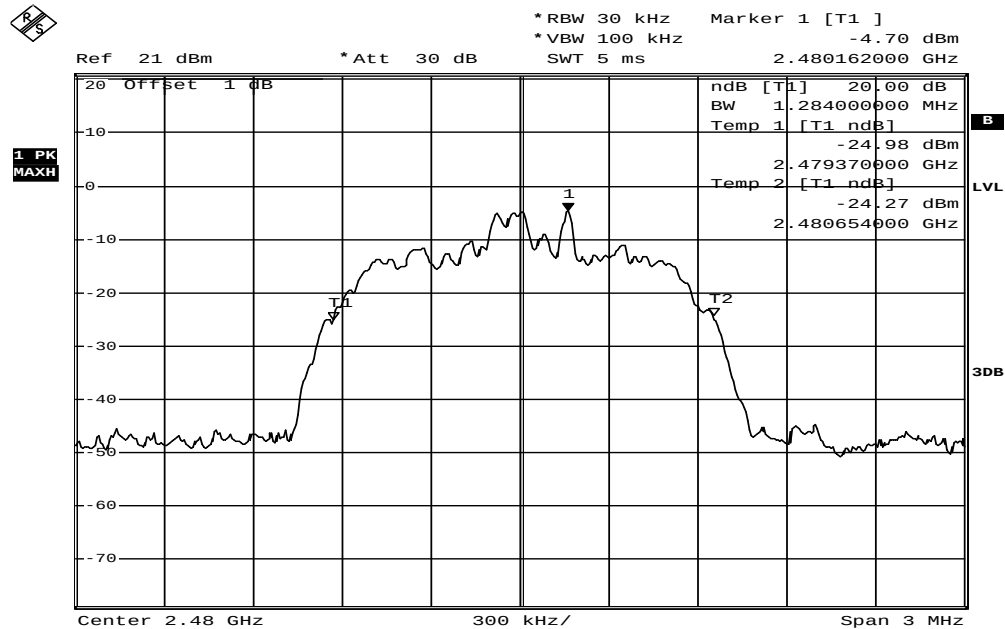
Date: 15.MAR.2016 13:13:29

20dB Bandwidth Test Data CH-Mid



Date: 15.MAR.2016 13:13:07

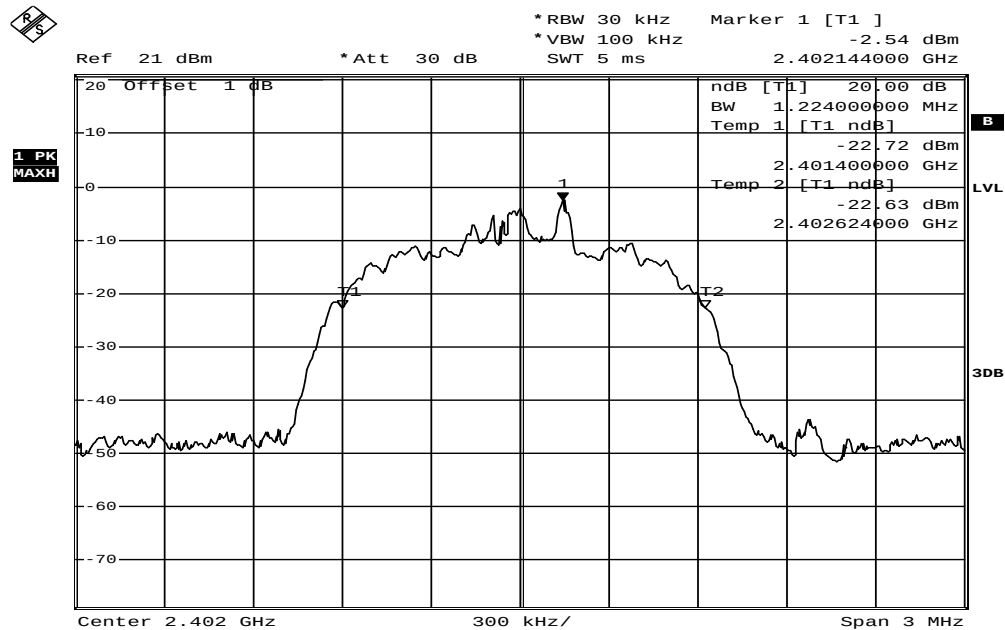
20dB Bandwidth Test Data CH-High



Date: 15.MAR.2016 13:12:41

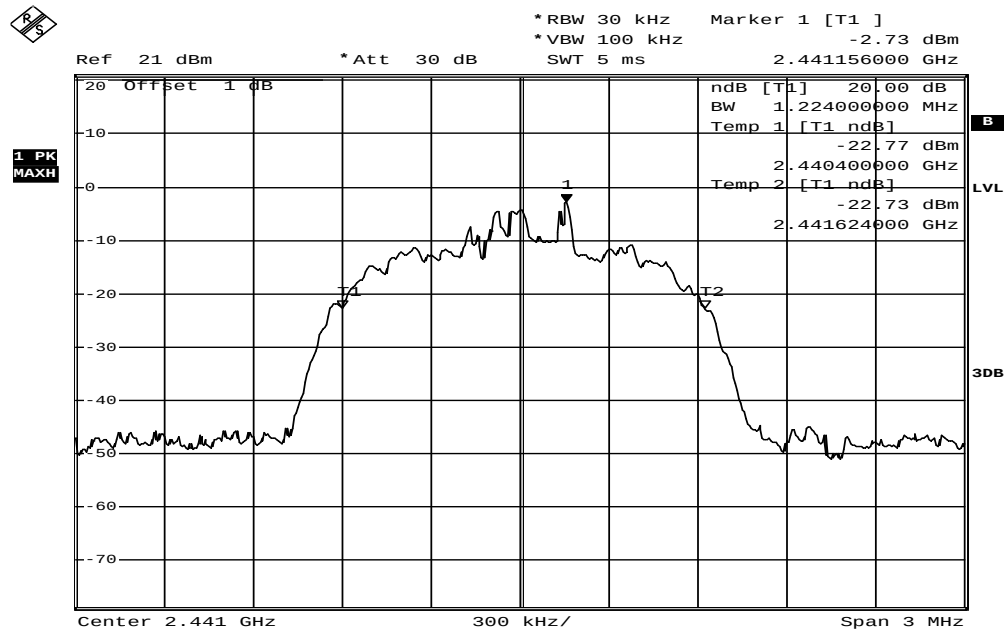
EDR 3M Mode

20dB Bandwidth Test Data CH-Low



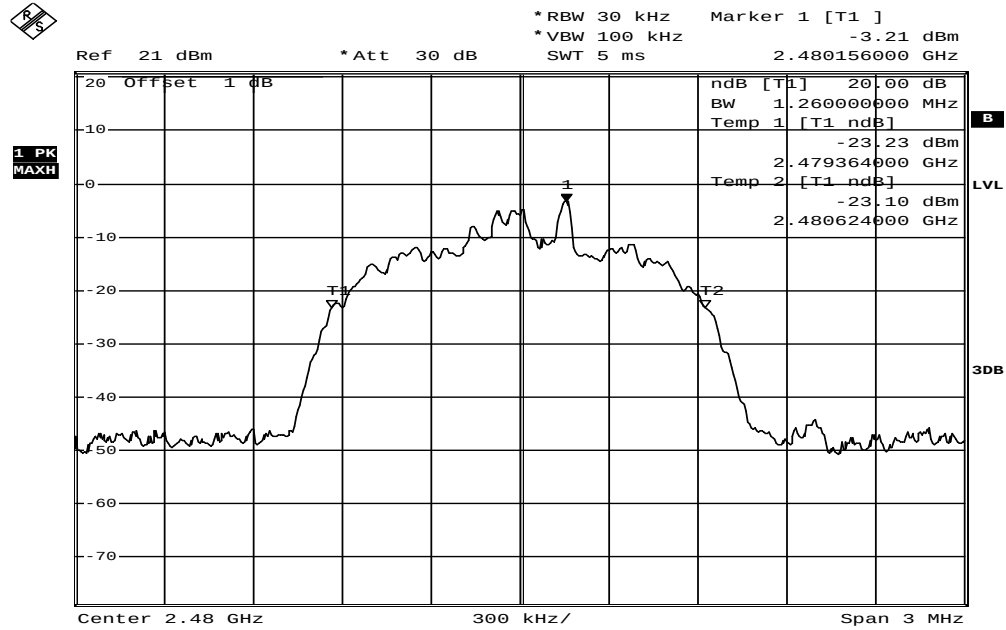
Date: 15.MAR.2016 13:13:55

20dB Bandwidth Test Data CH-Mid



Date: 15.MAR.2016 13:14:23

20dB Bandwidth Test Data CH-High



Date: 15.MAR.2016 13:14:46

13. ANTENNA REQUIREMENT

13.1. Standard Applicable:

According to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.

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

13.2. Antenna Connected Construction:

The directional gains of antenna used for transmitting is below table, and the antenna is designed with fixed type and no consideration of replacement. Please see EUT photo and antenna spec. for details.

Antenna Designation:

	Manufacturer	Type	Gain (2.4GHz)
Ant	Taiwan Tongda Communication Co., Ltd.	IPEX PIFA Antenna	-1.65dBi