

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT
INTENTIONAL RADIATOR CERTIFICATION TO
FCC PART 22 SUBPART H, PART 24 SUBPART E and PART 27 SUBPART
B, C & SUBPART L and PART 90S REQUIREMENT

OF

Applicant: Quanta Computer Inc.
No.188, Wenhua 2nd Rd., Guishan Dist., Taoyuan City 33377,
Taiwan

Product Name: QTAX53

Model No.: QTAX53

Model Difference: N/A

FCC ID: HFS-GW01

Report Number: E2/2018/40048

FCC Rule Part: 2, 22H & 27B, C & L

Issue Date: May. 04, 2018

Date of Test: Apr. 20, 2018(Conducted); Jul. 05, 2018(Radiated)

Date of EUT Received: Apr. 12, 2018

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Electronics & Communication Laboratory. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.26-2015 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits.

The test results of this report relate only to the tested sample identified in this report.

Tested By:

Vito Pei

Vito Pei / Engineer

Approved By:

Jim Chang

Jim Chang / Manager



Testing Laboratory
0513

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Revision History

Report Number	Revision	Description	Effected Page	Issue Date	Revised By
E2/2018/40048	Rev.00	Initial creation of document	All	May. 04, 2018	Elle Chang

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1. GENERAL PRODUCT INFORMATION

1.1. Product Description

General:

Product Name:	QTAX53	
Model No.:	QTAX53	
Model Difference:	N/A	
Hardware Version:	N/A	
Software Version:	N/A	
Power Supply:	3.8Vdc from Rechargeable Li-polymer Battery	
	Battery:	Model No.: PR-672426G, Supplier: EVE ENERGY CO., LTD.

1.2. WCDMA / LTE: Cellular Phone Standards Frequency Range

Operating Frequency (MHz)		
WCDMA / HSPA+ Band V	826.4	- 846.6

LTE Band	BW (MHz)	Operation Frequency (MHz)
13	5	779.5 - 784.5
	10	782

Antenna Designation

Vendor	Type	Main / Aux	Antenna Part No.	Modulation	Frequency (MHz)	Peak Antenna Gain (dBi)
Monopole	Amphenol	Main	EAX53002020	WCDMA / HSPA Band V	826.4 ~ 846.6	-1.93
				LTE Band 13	777 ~ 787	-2.03

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1.3. Type of Emission & Max ERP/EIRP Power Measurement Result:

	ERP / EIRP (dBm)		(W)	Type of Emission
WCDMA Band V	18.58	ERP	0.0721	4M13F9W

Band	BW (MHz)	Modulation	ERP / EIRP (dBm)		(W)	Type of Emission
13	5	QPSK	25.17	ERP	0.3289	4M50G7D
	5	16QAM	24.44	ERP	0.2780	4M51D7W
	10	QPSK	22.24	ERP	0.1754	8M92G7D
	10	16QAM	21.55	ERP	0.1429	8M95D7W

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1.4. Test Methodology of Applied Standards

CC 47 CFR Part 2, 22, 27

ANSI C63.26-2015

KDB971168 D01 Power Meas license Digital System v03

KDB941225 D01 SAR test for 3G devices v03r01 (SAR Measurement Procedures for 3G Devices, WCDMA / HSPA) was used for EUT and Base station setting.

TS 151 010-1 is used to set, and measure the output power.

Note: All test items have been performed and record as per the above standards.

1.5. Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.2, Keji 1st Rd.,
Guishan District, Taoyuan City, Taiwan 333 code 0513)

FCC Registration Numbers are: 735305 / TW0002

1.6. Special Accessories

No special accessories were used during testing.

1.7. Equipment Modifications

There were no modifications incorporated into the EUT.

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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 continuous transmission mode employed with the simulator of the Base Station that fixates at test default channels to fix the Tx frequency which was for the purpose of the measurements.

2.3. Test Procedure

2.3.1 Conducted Measurement at Antenna Port

According to measurement procured ANSI C63.26-2015, the EUT is placed on a turn table which is 0.8 m above ground plane. A low loss of RF cable was used to connect the antenna port of EUT to measurement equipment.

2.3.2 Radiated Emissions (ERP/EIRP)

According to measurement procured ANSI C63.26-2015, The EUT is a placed on as turn table, for emission measurements below 1 GHz is 0.8 m above ground plane, for emission measurements above 1 GHz, the table height shall be 1.5 m. 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 and 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 according to the requirements in Section 8 and 13.

2.4. Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

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Note:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Following shows an offset computation in physical test.

	RF cable loss (dB)	Attenuation factor(dB)	offset(dB)
Low Band (Below 1GHz)	4.3	10	14.3
High Band (Above 1 GHz)	4.8	10	14.8

2.5. Final Amplifier Voltage and Current Information:

Test Mode	DC voltage (V)	DC current (mA)
WCDMA B5	3.8V	0.709
LTE Band 13		0.830

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2.6. Configuration of Tested System

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

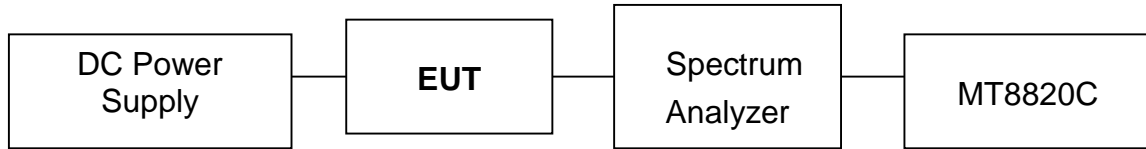
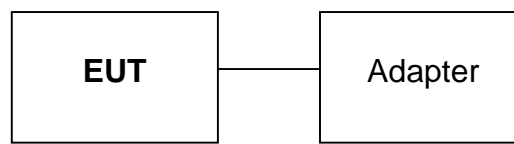


Fig. 2-2 Configuration of Tested System (Fixed Channel-Radiated)



Remote Side

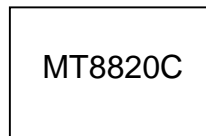


Table 2-1 Equipment Used in

Item	Equipment	Mfr/Brand	Model/ Type No.	Series No.	Data Cable	Power Cord
1.	Universal Radio Communication Tester	Anritsu	MT8820C	6201465317	shielded	Un-shielded

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3. SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§2.1046(a)	RF Power Output	Compliant
§2.1046(a) §22.913(a)(5) §24.232(c) §27.50(a)(3) §27.50(c)(10) §27.50(d)(4) §90.635	ERP/ EIRP measurement	Compliant
§2.1049(h)	99% & 26dB Occupied Bandwidth	Compliant
§2.1051 §22.917(a) §24.238(a) §27.53(g) §27.50(c)(5) §27.53(h) §27.53(m)(4)(6) §90.691	Out of Band Emissions at Antenna Terminals and Band Edge / Emission mask requirements	Compliant
§2.1053 §22.917(a) §24.238(a) §27.53(c)(2),(4) §27.50(c)(5) §27.53(f) §27.53(g) §27.53(h) §27.53(m)(4) §90.691(a)(1)(2)	Field Strength of Spurious Radiation	Compliant
§24.232(d) §27.53(d) (5) §27.50(i) (B)	Peak to Average Ratio	Compliant
§2.1055(a)(1) §22.355 §24.235 §27.54 §90.213	Frequency Stability	Compliant

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4. DESCRIPTION OF TEST MODES

4.1. The Worst Test Modes and Channel Details

1. The EUT has been tested under operating condition.
2. Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, X(E1)Y(E2)Z(H) axis and antenna ports. The worst case was found as listed below. Following channel(s) was (were) selected for the final test as listed below:

BAND	ERP/EIRP	RADIATED EMISSION
WCDMA/HSPA Band V	E1-plan	E1-plan
LTE Band 13	E2-plan	E2-plan

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WCDMA/HSPA MODE

TEST ITEM	AVAILABLE CHANNEL	TESTED CHANNEL	MODE
ERP	4132 to 4233	4132, 4183, 4233	WCDMA/HSPA Band V
EIRP	9262 to 9538	9262, 9400, 9538	WCDMA/HSPA Band II
FREQUENCY STABILITY	4132 to 4233 9262 to 9538	4183 9400	WCDMA Band II WCDMA Band V
OCCUPIED BANDWIDTH	4132 to 4233 9262 to 9538	4132, 4183, 4233 9262, 9400, 9538	WCDMA/HSPA Band II WCDMA/HSPA Band V
PEAK TO AVERAGE RATIO	4132 to 4233 9262 to 9538	4132, 4183, 4233 9262, 9400, 9538	WCDMA/HSPA Band II WCDMA/HSPA Band V
BAND EDGE	4132 to 4233 9262 to 9538	4132, 4233 9262, 9538	WCDMA Band II WCDMA Band V
CONDCUDED EMISSION	4132 to 4233 9262 to 9538	4132, 4183, 4233 9262, 9400, 9538	WCDMA Band II WCDMA Band V
RADIATED EMISSION	4132 to 4233 9262 to 9538	4132, 4183, 4233 9262, 9400, 9538	WCDMA Band II WCDMA Band V

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LTE Band 13 MODE

TEST ITEM	AVAILABLE CHANNEL	TESTED CHANNEL	CHANNEL BANDWIDTH	MODULATION	MODE
ERP	23205 to 23255	23205, 23230, 23255	5MHz	QPSK, 16QAM	1 RB/ 0,24 RB Offest
	23230	23230	10MHz	QPSK, 16QAM	1 RB/ 0,49 RB Offest
FREQUENCY STABILITY	23230	23230	10MHz	QPSK	Full RB
OCCUPIED BANDWIDTH	23205 to 23255	23205, 23230, 23255	5MHz	QPSK, 16QAM	Full RB
	23230	23230	10MHz	QPSK, 16QAM	Full RB
PEAK TO AVERAGE RATIO	23205 to 23255	23205, 23230, 23255	5MHz	16QAM	Full RB
	23230	23230	10MHz	16QAM	Full RB
BAND EDGE	23205 to 23255	23205, 23255	5MHz	QPSK	1 RB/ 0,24 RB Offest Full RB
	23230	23230	10MHz	QPSK	1 RB/ 0,49 RB Offest Full RB
CONDCUDED EMISSION	23205 to 23255	23205, 23230, 23255	5MHz	QPSK	1 RB, 0 RB Offest
	23230	23230	10MHz	QPSK	1 RB, 0 RB Offest
RADIATED EMISSION	23205 to 23255	23205, 23230, 23255	5MHz	16QAM	1 RB/ 24 RB Offest

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5. MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
RF Power Output	+/- 1.10 dB
ERP/ EIRP measurement	Vertical Polarization = +/- 4.74dB Horizontal Polarization = +/- 4.62dB
99% Occupied Bandwidth	+/- 5.19 Hz
Out of Band Emissions at Antenna Terminals and Band Edge	+/- 0.70 dB
Peak to Average Ratio	+/- 0.70 dB
Frequency Stability vs. Temperature	+/- 5.19 Hz
Frequency Stability vs. Voltage	+/- 5.19 Hz
Temperature	+/- 0.65 °C
Humidity	+/- 4.6 %
DC / AC Power Source	DC= +/- 0.13%, AC= +/- 0.2%

Radiated Spurious Emission:

Measurement uncertainty (Polarization : Vertical)	9kHz – 30MHz: +/- 2.87 dB
	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB

Measurement uncertainty (Polarization : Horizontal)	9kHz – 30MHz: +/- 2.87 dB
	30MHz - 167MHz: +/- 4.22dB
	167MHz -500MHz: +/- 3.44dB
	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

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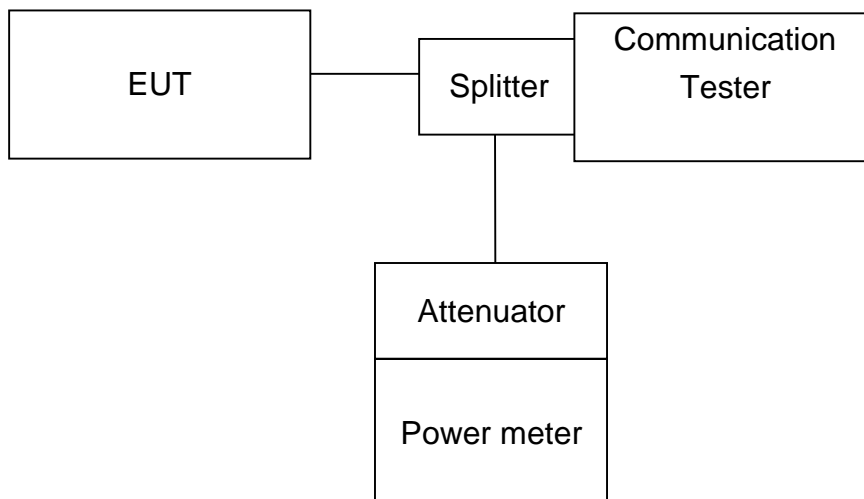
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6. RF CONDUCTED OUTPUT POWER MEASUREMENT

6.1. Standard Applicable

A base station simulator was used to establish communication with the EUT. Its parameters were set to transmit the maximum power on the EUT. The measured power in the radio frequency on the transmitter output terminals.

6.2. Test Set-up



Note: Measurement setup for testing on Antenna connector

6.3. Measurement Procedure

The transmitter output was connected to a calibrated attenuator, the other end of which was connected to a power meter. Transmitter output was read off the power meter in dBm. The power output at the transmitter antenna port was determined by adding the value of the attenuator to the power meter reading. TS 151 010-1 is reference to conduct the test measurement of output power.

The Procedure of KDB941225 (SAR Measurement Procedures for 3G devices, (WCD-MA/HSPA) was used for EUT and Base station setting. RMC 12.2kps is used for this testing, and KDB 971168 D01 Power Meas License Digital System as the supplemental test methodology to adjust the proper setting obtaining the measurement results

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6.4. Measurement Equipment Used

Conducted Emission (measured at antenna port) Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Radio Communication Analyser	Anritsu	MT8820C	6201465317	2018/01/17	2019/01/16
Attenuator	Mini-Circuit	BW-S10W2+	2	2018/01/02	2019/1/1
Coaxial Cables	N/A	WK CE Cable	N/A	2018/01/02	2019/1/1

6.5. Measurement Result

RF Conducted Output Power

WCDMA MODE:

The following tests were completed according to the test requirements outlined in section 5.2 of the 3GPP TS34.121-1 V8.4.0 specification. The EUT supports power Class 3, which has a nominal maximum output power of 24 dBm (+1.7/-3.7). RMC 12.2kps is used for this testing.

Results:

BNAD V	Avg. Power (dBm) Channel		
	4132	4183	4233
WCDMA	22.89	22.71	22.69

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LTE Result:

LTE Band 13_Uplink frequency band : 777 to 787 MHz								
BW (MHz)	RB Size	RB Offset	Conducted power (dBm)					
			QPSK			16QAM		
			CH (Low) 23205	CH (Mid) 23230	CH (High) 23255	CH (Low) 23205	CH (Mid) 23230	CH (High) 23255
5	1	0	23.22	23.11	23.24	22.24	21.74	22.83
	1	24	23.24	23.25	23.28	22.62	21.80	23.00
	12	6	22.04	22.08	22.22	21.10	21.14	21.28
	25	0	21.85	22.25	22.28	21.02	21.30	21.23

LTE Band 13_Uplink frequency band : 777 to 787 MHz								
BW (MHz)	RB Size	RB Offset	Conducted power (dBm)					
			QPSK			16QAM		
			CH (Mid) 23230			CH (Mid) 23230		
10	1	0	23.17			22.36		
	1	49	23.44			22.37		
	25	12	22.19			21.33		
	50	0	22.38			21.51		

WCDMA/HSDPA/HSUPA band II, IV, V

The EUT output power was controlled by simulator. Set Communication Tester MT8820C function key "UE Power Control" and enter max rated power 24dBm. The EUT is going to be set to max output power to 24dBm. Then record the read (see page 15 for measurement data). The min. power was measures by a function key "minimum power" then record the read. It is -52.3dBm. The power variation can be 0.1dB step by setting.

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7. EFFECTIVE RADIATED POWER AND EQUIVALENT ISOTROPIC RADIATED POWER MEASUREMENT

7.1. Standard Applicable

According to FCC §2.1046

FCC 22.913(a) Mobile station is limited to 7W ERP.

FCC 24.232(b) Mobile and portable stations are limited to 2 W EIRP.

FCC 27.50(a)(3) Mobile and portable stations (hand-held devices) are limited to 250 mW/ 5MHz EIRP.

FCC 27.50(b)(10) Portable stations (hand-held devices) transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands are limited to 3 watts ERP.

FCC 27.50(c)(10) Portable stations (hand-held devices) are limited to 3 watts ERP.

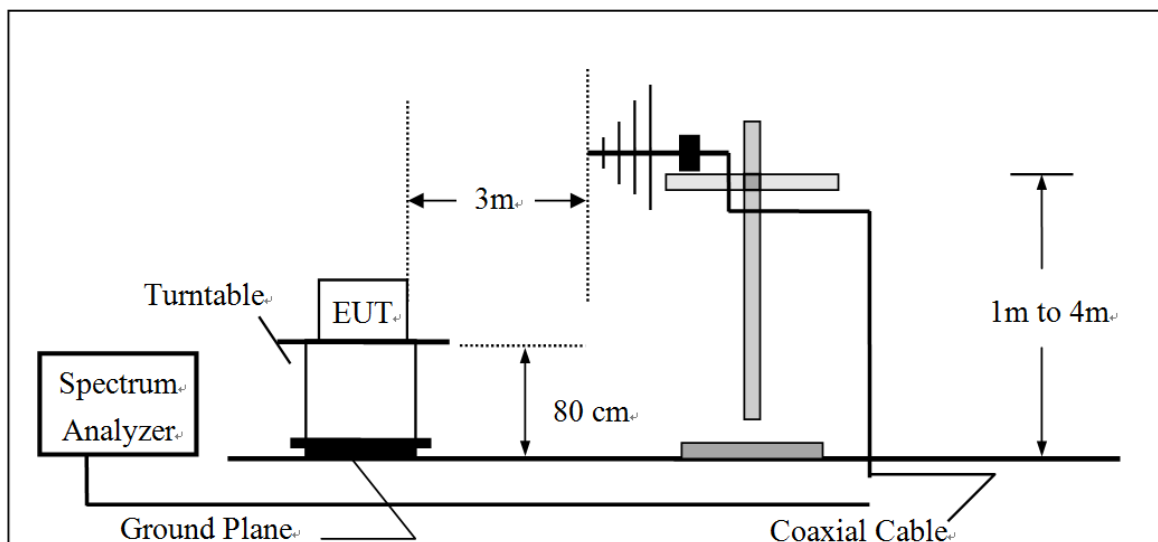
FCC 27.50(d)(4) Fixed, mobile, and portable (hand-held) stations are limited to 1W EIRP.

FCC 27, 50(h)(2) Mobile and other user stations. Mobile stations are limited to 2 W EIRP

FCC 90.635(b) Mobile station is limited to 100W ERP

7.2. Test SET-UP

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

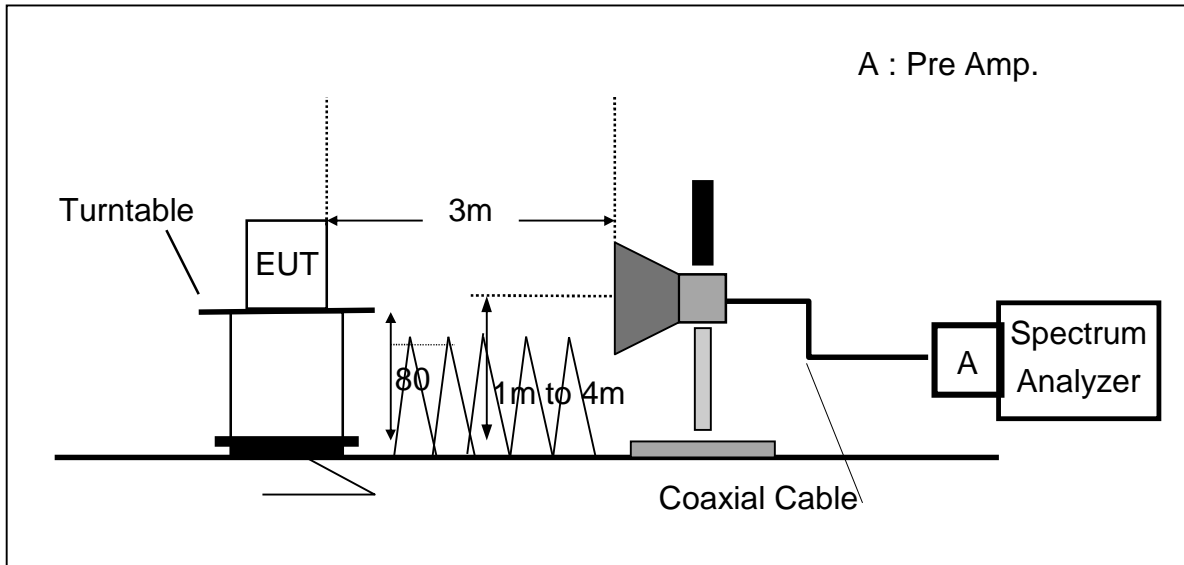


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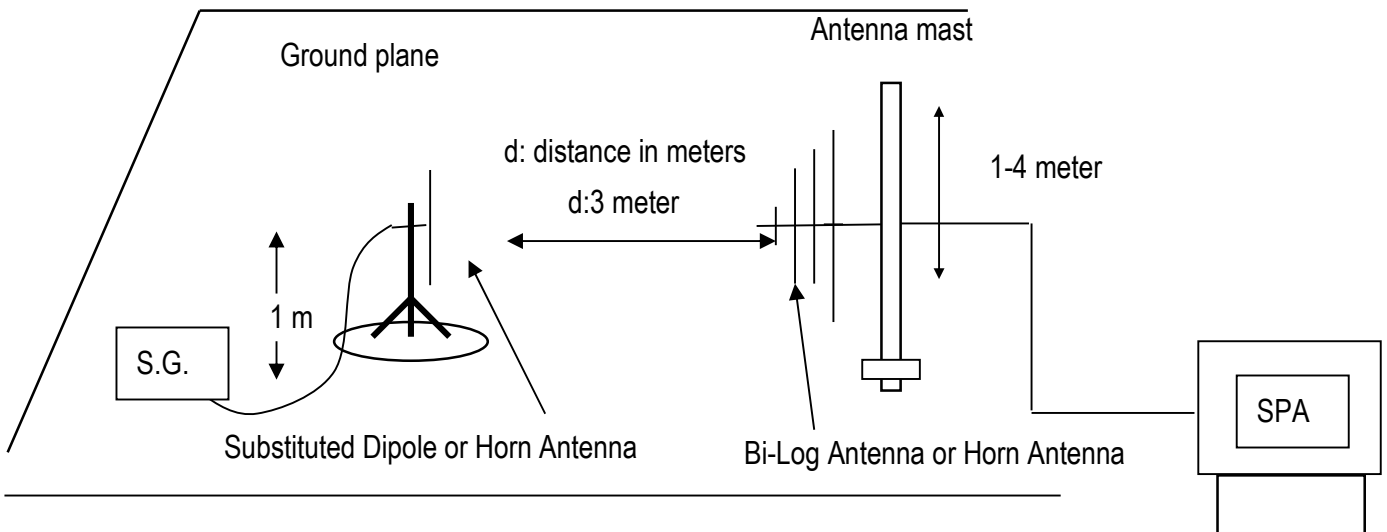
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(B) Radiated Power Test Set-UP Frequency Over 1 GHz



(C) Substituted Method Test Set-UP



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7.3. Measurement Procedure

1. The testing follows the Measurement Procedure of FCC KDB 971168 D01
2. The EUT was placed on a non-conductive turntable using a non-conductive support. The radiated emission at the fundamental frequency was measured at 3 m with a test antenna and EMI spectrum analyzer.
3. During the measurement, the EUT was communication with the station. The highest emission was recorded with the rotation of the turntable and the lowering of the test antenna from 4m to 1m. The reading was recorded and the field strength (E in dBuV/m) was calculated
4. The testing follows the Measurement Procedure of FCC KDB 971168 D01
5. The substitution horn antenna is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a tx cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to "Read Value" of step b. Record the power level of S.G.
6. $ERP = S.G. \text{ output (dBm)} + \text{Antenna Gain (dBd)} - \text{Cable Loss (dB)}$
7. $EIRP = S.G. \text{ output (dBm)} + \text{Antenna Gain (dBi)} - \text{Cable Loss (dB)}$
8. Spectrum setting:
 - (1) Detector = Peak, marker the highest value of the detector by maximum hold, set RBW wide enough to capture the entire signal of emission, and $VBW \geq 3 \times RBW$.
 - (2) KDB 971168 D01 is adopted, and the procedure as lists under item 4, Measurement of the Average Power over the Fundamental Signal Bandwidth, is followed to set correspondingly for the acquisition of proper measurement data.

Set frequency = nominal signal center frequency;
 Set span = 2 X occupied BW;
 Set RBW \approx 1~5% of the span, not to exceed 1 MHz
 Set VBW = 3 x RBW;
 Select average power (RMS) detector
 Set sweep time and number of measurement points to achieve a minimum of 1 millisecond/pt integration time (ex. Point = 601points, then sweep time = $601 \times 10^{-3} = 6s$.)

Activate trace averaging routine over a minimum of 10 sweeps;

Activate marker/span pair and set span = signal or channel bandwidth;

Activate the band/interval power marker function;

Record the band power level;

Record adjusted value as the average signal power level. Then activate the occupied bandwidth measurement function.

The proper adjustment due to limitation of spectrum capability is given compensated to spectrum with conversion factor of $10 \times \log(TBW/RBW)$, where TBW is the transmission of UE exceeding the maximum BW UE can extends, and RBW is the resolution BW in UE.

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7.4. Measurement Equipment Used

ERP, EIRP MEASUREMENT EQUIPMENT List 966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Broadband Antenna	SCHWAZBECK	VULB 9168	9168-617	10/27/2017	10/26/2018
Horn Antenna	Schwarzbeck	BBHA9120D	1341	05/31/2017	05/30/2018
Loop Antenna	ETS.LINDGREN	6502	148045	09/26/2017	09/25/2018
3m Site NSA	SGS	966 chamber D	N/A	07/06/2017	07/05/2018
Spectrum Analyzer	Agilent	N9010A	MY53400256	10/30/2017	10/29/2018
Radio Communication Analyer	Anritsu	MT8820C	6201107337	06/11/2017	06/10/2018
Pre-Amplifier	EMC Instruments	EMC184045B	980135	10/27/2017	10/26/2018
Pre-Amplifier	EMC Instruments	EMC9135	980234	12/26/2017	12/25/2018
Pre-Amplifier	EMC Instruments	EMC12630SE	980271	12/26/2017	12/25/2018
Attenuator	Marvelous	MVE2213-30	RF28	12/26/2017	12/25/2018
DC Block	PASTERNAK	PE8210	RF81	12/26/2017	12/25/2018
High Pass Filter	Micro-Tronics	G003	RF99	12/26/2017	12/25/2018
Notch Filter	Woken	EWT-54-0037	RF54	12/26/2017	12/25/2018
Coaxial Cable	Huber+Suhner	RG 214/U	W21.01	12/26/2017	12/25/2018
Coaxial Cable	Huber Suhner	EMC106-SM-S M-7200	150703	12/26/2017	12/25/2018

ERP, EIRP MEASUREMENT EQUIPMENT List 966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Horn Antenna	Schwarzbeck	BBHA9120D	1341	05/31/2018	05/30/2019
3m Site NSA	SGS	966 chamber D	N/A	07/06/2018	07/05/2019
Radio Communication Analyer	Anritsu	MT8820C	6201107337	06/11/2018	06/10/2019

Note: The measurement was taken place with the long duration of the time, and additional equipment list as shown above indicate those equipment of which has been subject to undertake the calibration in intermediate period of time of the measurement.

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7.5. Measurement Result: (Peak) –using option of peak measurement

Part22								
EUT			Measurement					
Operation Band	Fundamental Frequency	CH	Antenna Pol.	S.G. Output	Antenna Gain	Cable Loss	ERP	Limit
	MHz		V/H	dBm	dBd	dB	dBm	dBm
WCDMA Band V	826.4	4132	V	17.83	-1.93	-1.57	14.33	38.45
			H	21.08	-1.93	-1.58	17.57	38.45
	836.6	4183	V	19.82	-1.94	-1.61	16.27	38.45
			H	22.14	-1.95	-1.61	18.58	38.45
	846.6	4233	V	20.08	-1.96	-1.65	16.47	38.45
			H	19.93	-1.96	-1.65	16.32	38.45

Remark:
(1) The RBW,VBW of SPA for frequency RBW=5 MHz, VBW=8MHz

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EUT			Measurement					
Operation Band	Fundamental Frequency	CH	Antenna Pol.	S.G. Output	Antenna Gain	Cable Loss	ERP	Limit
	MHz		V/H	dBm	dBd	dB	dBm	dBm
LTE BAND 13 BW: 5M QPSK RB: 1,0	779.5	23205	V	24.82	-2.11	-1.63	21.08	34.77
			H	28.38	-2.11	-1.63	24.64	34.77
	782.0	23230	V	25.75	-2.09	-1.62	22.04	34.77
			H	28.88	-2.09	-1.62	25.17	34.77
	784.5	23255	V	24.02	-2.07	-1.62	20.33	34.77
			H	26.82	-2.06	-1.62	23.14	34.77
LTE BAND 13 BW: 5M QPSK RB: 1,24	779.5	23205	V	24.46	-2.07	-1.62	20.77	34.77
			H	27.24	-2.07	-1.62	23.55	34.77
	782.0	23230	V	24.36	-2.05	-1.61	20.70	34.77
			H	26.70	-2.05	-1.61	23.04	34.77
	784.5	23255	V	24.50	-2.03	-1.61	20.86	34.77
			H	26.61	-2.03	-1.61	22.97	34.77
LTE BAND 13 BW: 5M 16QAM RB: 1,0	779.5	23205	V	24.67	-2.11	-1.63	20.93	34.77
			H	28.03	-2.11	-1.63	24.29	34.77
	782.0	23230	V	24.83	-2.09	-1.62	21.12	34.77
			H	28.14	-2.08	-1.62	24.44	34.77
	784.5	23255	V	23.60	-2.06	-1.62	19.92	34.77
			H	26.33	-2.06	-1.62	22.65	34.77
LTE BAND 13 BW: 5M 16QAM RB: 1,24	779.5	23205	V	24.03	-2.07	-1.62	20.34	34.77
			H	26.56	-2.07	-1.62	22.87	34.77
	782.0	23230	V	23.52	-2.05	-1.61	19.86	34.77
			H	26.40	-2.04	-1.61	22.75	34.77
	784.5	23255	V	23.82	-2.02	-1.60	20.20	34.77
			H	26.31	-2.03	-1.60	22.68	34.77

Remark : (1)The RBW,VBW of SPA for frequency RBW= 8MHz , VBW= 8MHz

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EUT			Measurement					
Operation Band	Fundamental Frequency	CH	Antenna Pol.	S.G. Output	Antenna Gain	Cable Loss	ERP	Limit
	MHz		V/H	dBm	dBd	dB	dBm	dBm
LTE BAND 13 BW: 10M QPSK RB: 1,49	782.0	23230	V	25.25	-2.11	-1.63	21.51	34.77
			H	25.98	-2.11	-1.63	22.24	34.77
LTE BAND 13 BW: 10M QPSK RB: 1,49	782.0	23230	V	24.85	-2.11	-1.63	21.11	34.77
			H	25.45	-2.11	-1.63	21.71	34.77
LTE BAND 13 BW: 10M 16QAM RB: 1,49	782.0	23230	V	24.19	-2.03	-1.61	20.55	34.77
			H	25.19	-2.03	-1.61	21.55	34.77
LTE BAND 13 BW: 10M 16QAM RB: 1,49	782.0	23230	V	23.87	-2.03	-1.61	20.23	34.77
			H	24.82	-2.03	-1.60	21.19	34.77

Remark : (1)The RBW,VBW of SPA for frequency RBW= 8MHz , VBW= 8MHz

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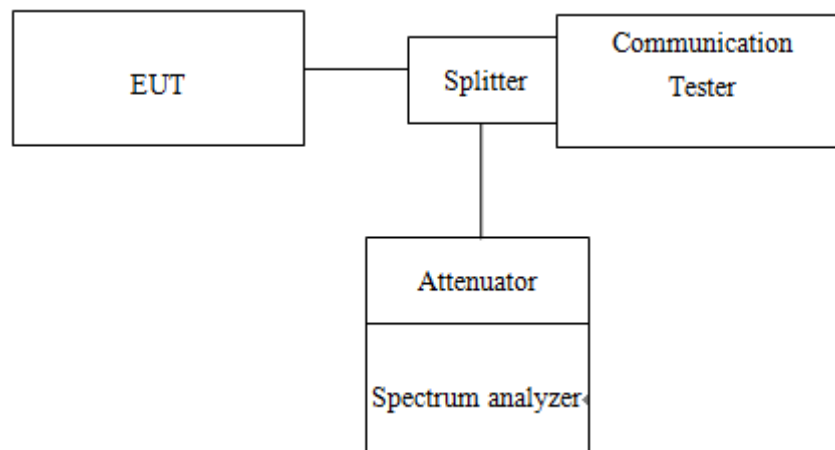
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8. OCCUPIED BANDWIDTH MEASUREMENT

8.1. Standard Applicable

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power.

8.2. Test Set-up



8.3. Measurement Procedure

99% &26dB Bandwidth with detector peak

The EUT's output RF connector was connected with a short cable to the spectrum analyzer, RBW was set to about 1% of emission BW, VBW= 3 times RBW, -26dBc display line was placed on the screen (or 26dB bandwidth), the occupied bandwidth is the delta frequency between the two points where the display line intersects the signal trace. Then set RBW to 99% bandwidth, RBW= 1%, VBW= 3 RBW, with span > 2 * Signal BW, set % Power = 99%.

99% Bandwidth with detector sample

The EUT's output RF connector was connected with a short cable to the spectrum analyzer, RBW was set to about 1% ~ 5% of emission BW, VBW= 3 times RBW, -20dBc display line was placed on the screen (or 20dB bandwidth). Set RBW to 99% bandwidth, RBW= 1% ~ 5%, VBW= 3 RBW, with span > 2 * Signal BW, set % Power = 99%.

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8.4. Measurement Equipment Used

Conducted Emission (measured at antenna port) Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010A	MY51440113	06/20/2017	06/19/2018
Communication Tester	Anritsu	MT8820C	6201107337	06/11/2017	06/10/2018
Coaxial Cable 30cm	WOKEN	00100A1F1 A195C	RF01	12/24/2017	12/23/2018
Temperature Chamber	TERCHY	MHK-120LK	1020582	06/13/2017	06/12/2018
DC Block	PASTERNAK	PE8210	RF29	12/24/2017	12/23/2018
Splitter	RF-LAMBAD	RFLT2W1G 18G	RF35	12/24/2017	12/23/2018
Attenuator	WOKEN	218FS-10	RF23	12/24/2017	12/23/2018
DC Power Supply	Agilent	E3640A	MY53140006	05/02/2017	05/01/2018

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8.5. Measurement Result

Freq. (MHz)	CH	99% BW (MHz)	26 dB BW (MHz)
		WCDMA V	WCDMA V
826.40	4132	4.13860	4.68540
836.60	4183	4.13240	4.66710
846.60	4233	4.11780	4.67790

LTE BAND 13 Channel bandwidth: 5MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
779.5	23205	4.5093	4.5146	5.0094	5.0465
782.0	23230	4.4819	4.4762	4.9415	4.9824
784.5	23255	4.5016	4.5059	5.0158	5.0335

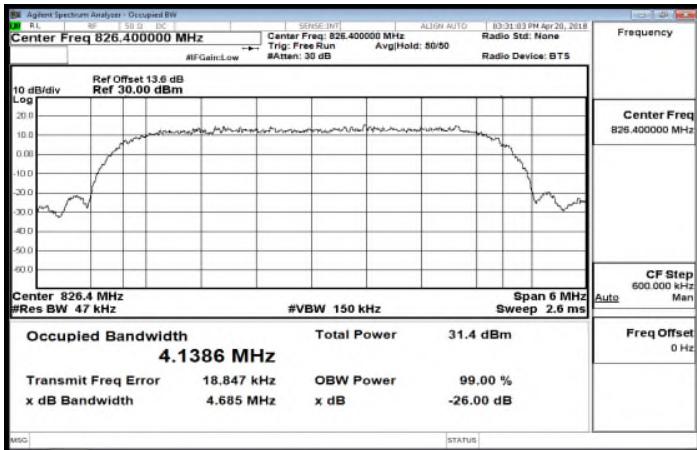
LTE BAND 13 Channel bandwidth: 10MHz					
Freq. (MHz)	CH	99% BW (MHz)		26 dB BW (MHz)	
		QPSK	16QAM	QPSK	16QAM
782.0	23230	8.927	8.951	9.750	9.822

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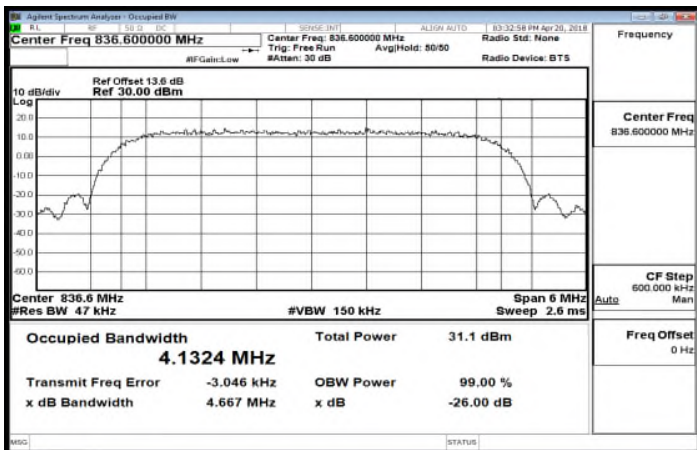
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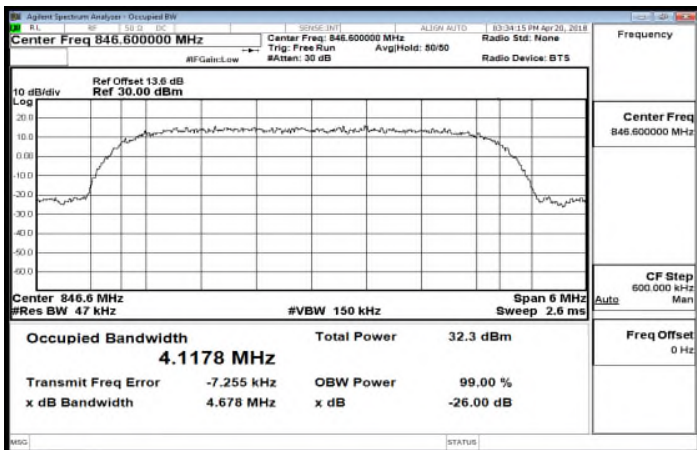
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WCDMA_B5_MidCH4183-836.6



WCDMA_B5_HighCH4233-846.6

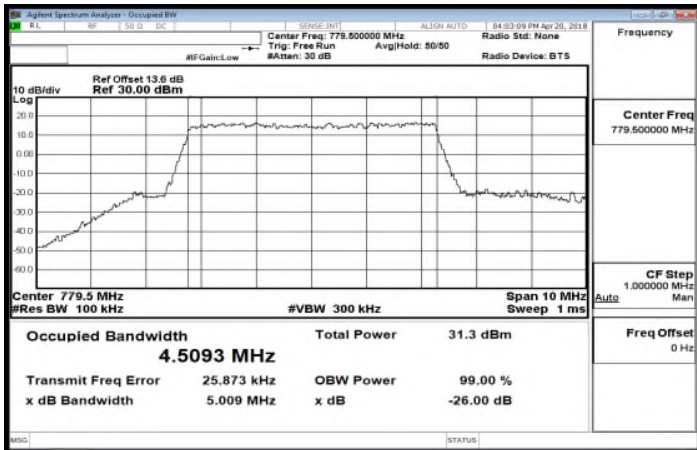


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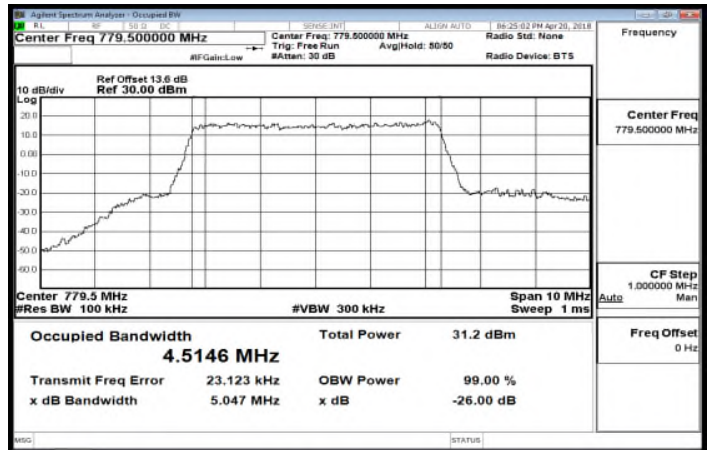
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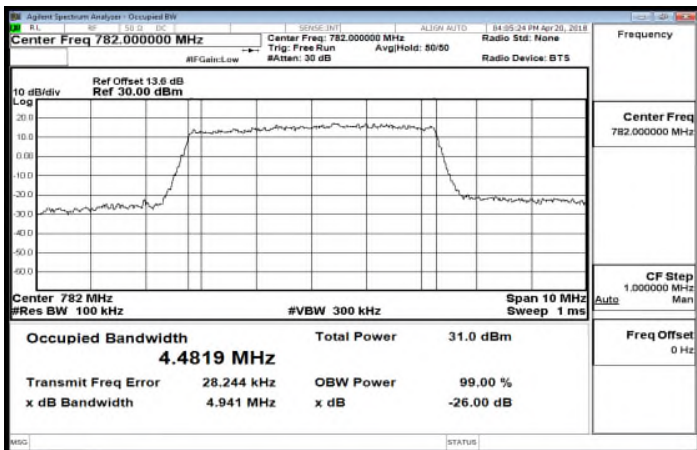
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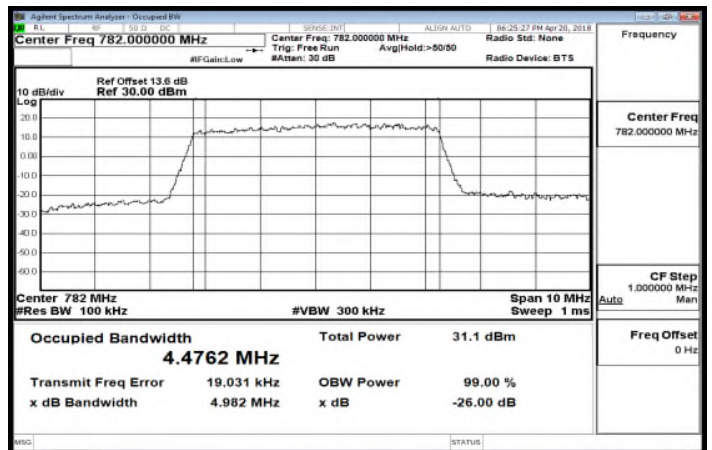
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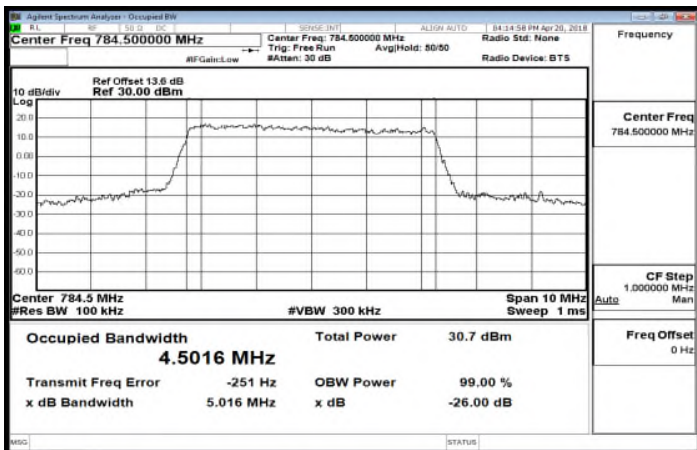
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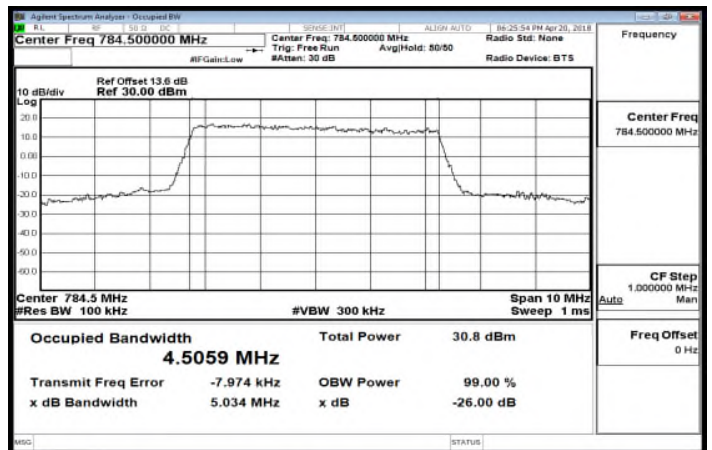
Band13_5MHz_16QAM_25_0_MidCH23230-782



Band13_5MHz_QPSK_25_0_HighCH23255-784.5



Band13_5MHz_16QAM_25_0_HighCH23255-784.5

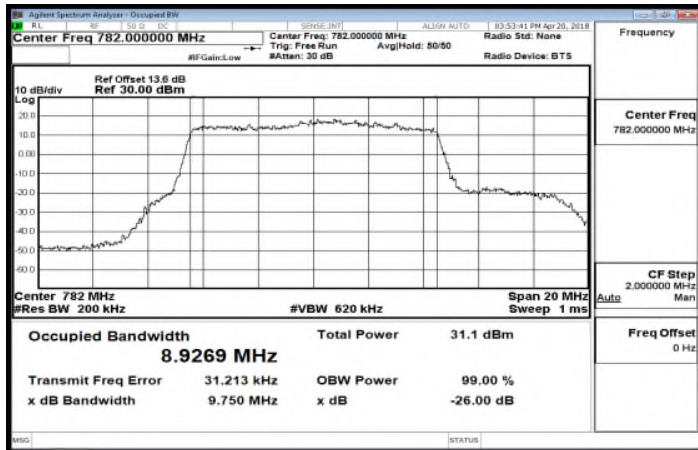


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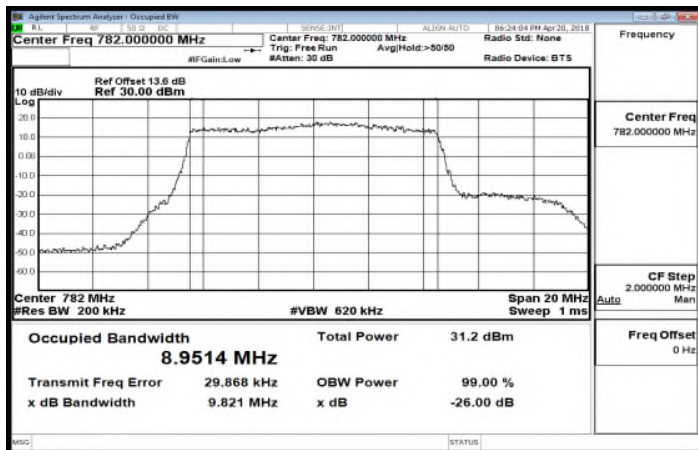
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Band13_10MHz_QPSK_50_0_MidCH23230-782



Band13_10MHz_16QAM_50_0_MidCH23230-782



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9. OUT OF BAND EMISSION AT ANTENNA TERMINALS

9.1. Standard Applicable

FCC §22.917(a), §24.238(a), §27.53(h), Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

FCC §27.53(c)

(c) For operations in the 746–758 MHz band and the 776–788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(2) On any frequency outside the 776–788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log(P)$ dB (-13dBm)

(4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than $65 + 10 \log(P)$ dB in a 6.25 kHz band segment, for mobile and portable stations;

§27.53 (f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

FCC §27.53(c) (5) & FCC §27.53(g)

Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

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FCC §27.53(h) (3)

Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

FCC §27.53(m) (4) (6)

For mobile digital stations, the attenuation factor shall be not less than $40 + 10 \log (P)$ dB on all frequencies between the channel edge and 5 megahertz from the channel edge, $43 + 10 \log (P)$ dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and $55 + 10 \log (P)$ dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less than $43 + 10 \log (P)$ dB on all frequencies between 2490.5 MHz and 2496 MHz and $55 + 10 \log (P)$ dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed; for mobile digital stations, in the 1 megahertz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least two percent may be employed, except when the 1 megahertz band is 2495-2496 MHz, in which case a resolution bandwidth of at least one percent may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 megahertz or 1 percent of emission bandwidth, as specified; or 1 megahertz or 2 percent for mobile digital stations, except in the band 2495-2496 MHz). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power. With respect to television operations, measurements must be made of the separate visual and aural operating powers at sufficiently frequent intervals to ensure compliance with the rules.

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§90.691 Emission mask requirements for EA-based systems.

(a) Out-of-band emission requirement shall apply only to the “outer” channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $116 \text{ Log}_{10}(f/6.1)$ decibels or $50 + 10 \text{ Log}_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

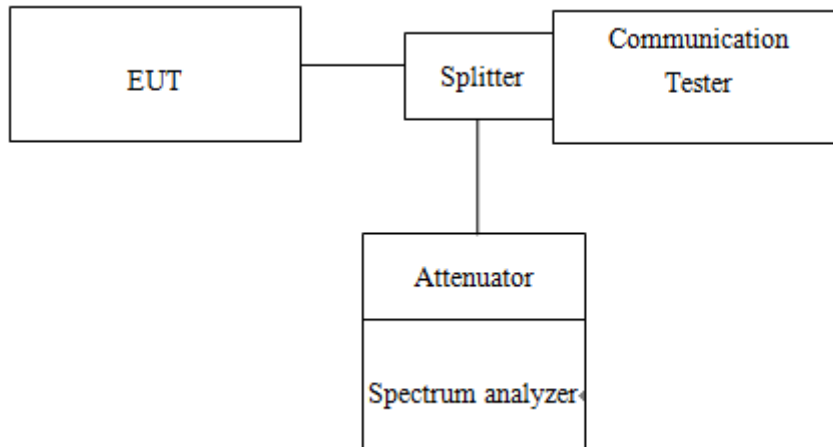
(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \text{ Log}_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

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9.2. Test SET-UP



9.3. Measurement Procedure

Conducted Emission

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 1MHz, sufficient scans were taken to show the out of band Emissions if any up to 10th harmonic.

1. To connect Antenna Port of EUT to Spectrum.
2. Set RBW = 1MHz & VBW = 1MHz on Spectrum.
3. Allow trace to fully stabilize
4. Repeat above procedures until all default test channel measured were complete.

Band Edge

1. To connect Antenna Port of EUT to Spectrum.
2. The band edge of low and high channels for the highest RF powers was measured. Setting RBW \geq 1% EBW.
3. Allow trace to fully stabilize
4. Repeat above procedures until all default test channel measured were complete.

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9.4. Measurement Equipment Used

Conducted Emission (measured at antenna port) Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EXA Spectrum Analyzer	Agilent	N9010A	MY54200716	2017/10/16	2018/10/15
Radio Communication Analyzer	Anritsu	MT8820C	6201465317	2018/01/17	2019/01/16
Attenuator	Mini-Circuit	BW-S10W2+	2	2018/01/02	2019/1/1
Splitter	RF-LAMBAD	RFLT2W1G18G	11-JSPF412-018	2018/01/02	2019/1/1
Coaxial Cables	N/A	WK CE Cable	N/A	2018/01/02	2019/1/1
EXA Spectrum Analyzer	Agilent	N9010A	MY54200716	2017/10/16	2018/10/15
Radio Communication Analyzer	Anritsu	MT8820C	6201465317	2018/01/17	2019/01/16
Attenuator	Mini-Circuit	BW-S10W2+	2	2018/01/02	2019/1/1
Splitter	RF-LAMBAD	RFLT2W1G18G	11-JSPF412-018	2018/01/02	2019/1/1

9.5. Measurement Result:

Refer to next pages.

NOTE: The occurrence of the spike on the conducted emission is the signal of the fundamental emission.

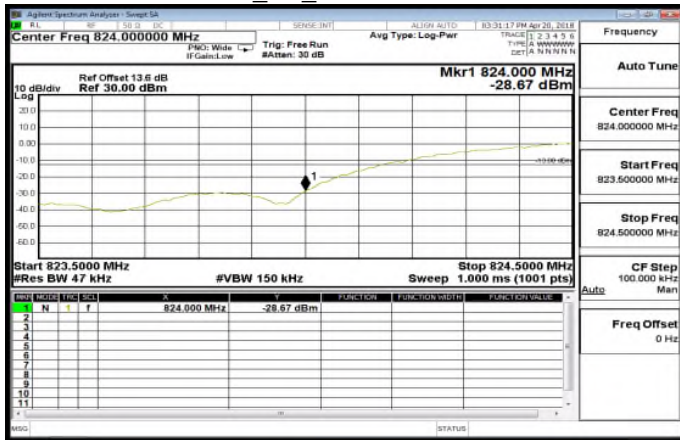
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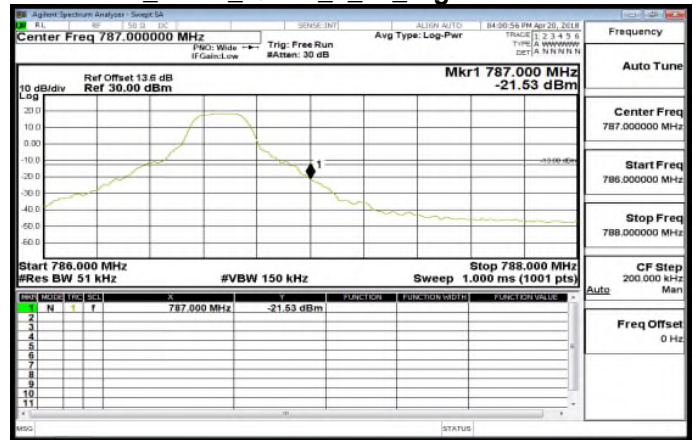
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Band edge

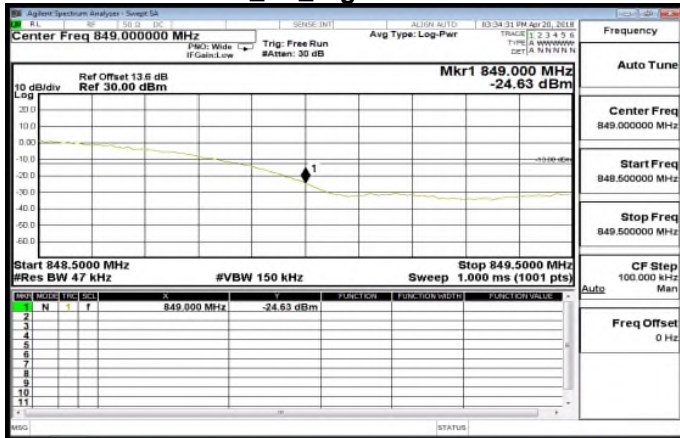
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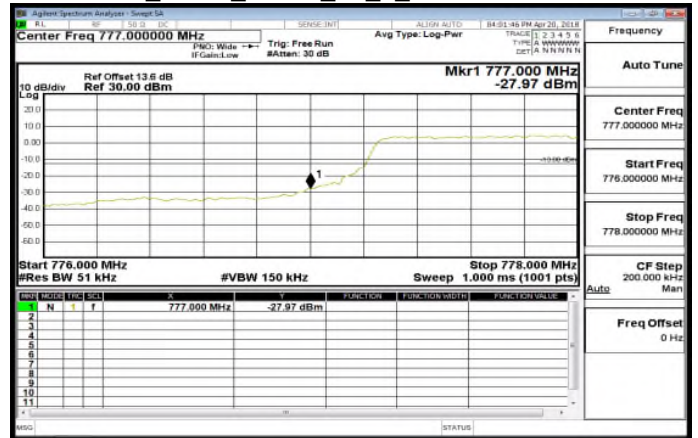
Band13_5MHz_QPSK_1_24_HighCH23255-784.5



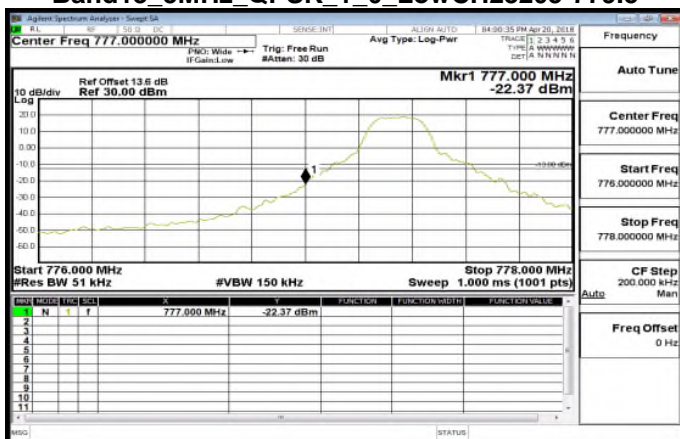
WCDMA_B5_HighCH4233-846.6



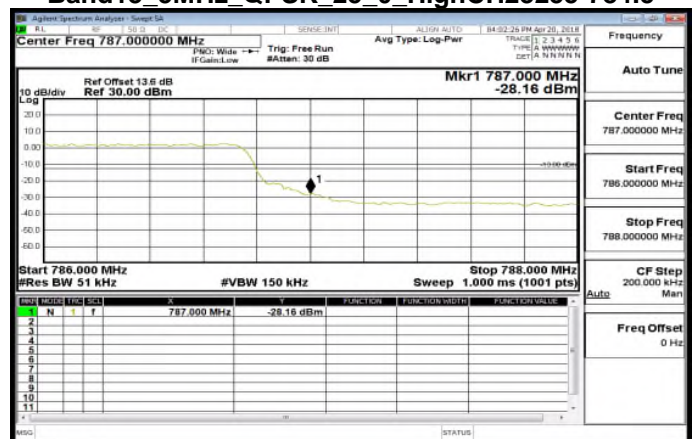
Band13_5MHz_QPSK_25_0_LowCH23205-779.5



Band13_5MHz_QPSK_1_0_LowCH23205-779.5



Band13_5MHz_QPSK_25_0_HighCH23255-784.5

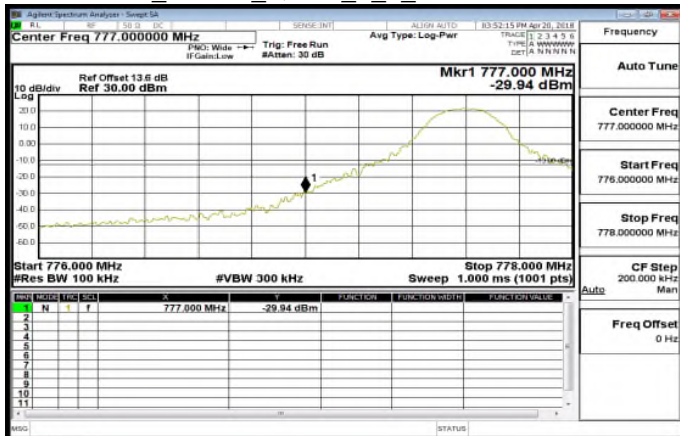


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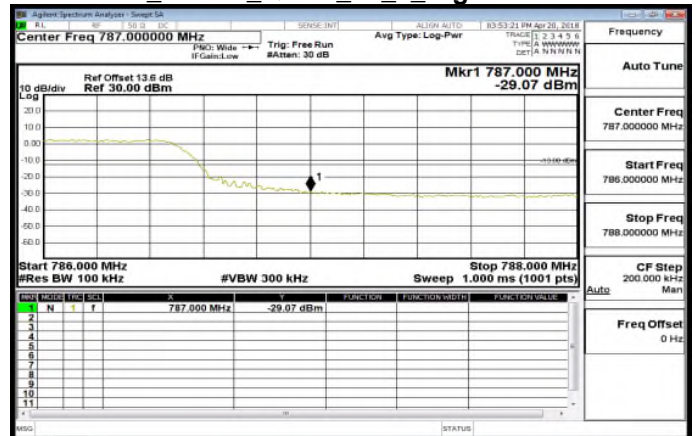
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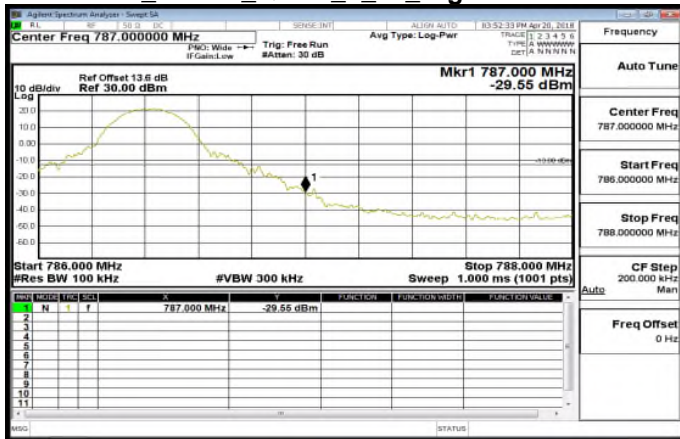
Band13 10MHz_QPSK_1_0_LowCH23230-782



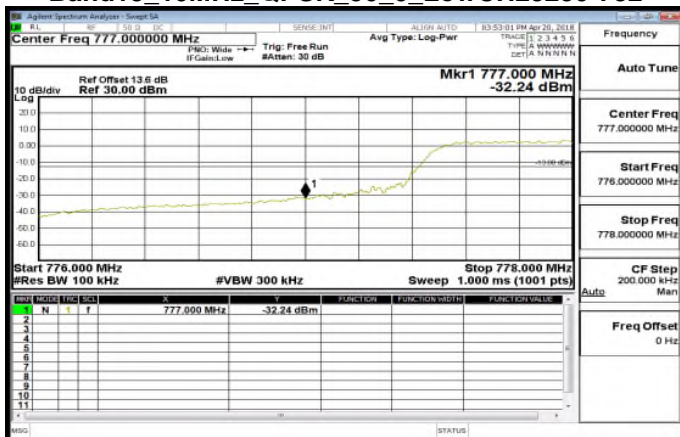
Band13 10MHz_QPSK_50_0_HighCH23230-782



Band13 10MHz_QPSK_1_49_HighCH23230-782



Band13 10MHz_QPSK_50_0_LowCH23230-782

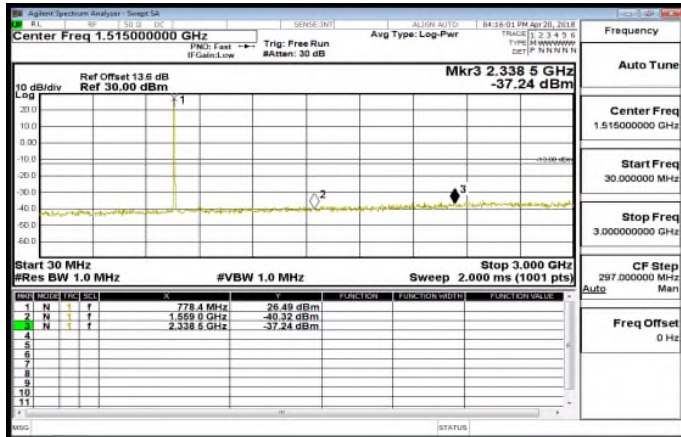


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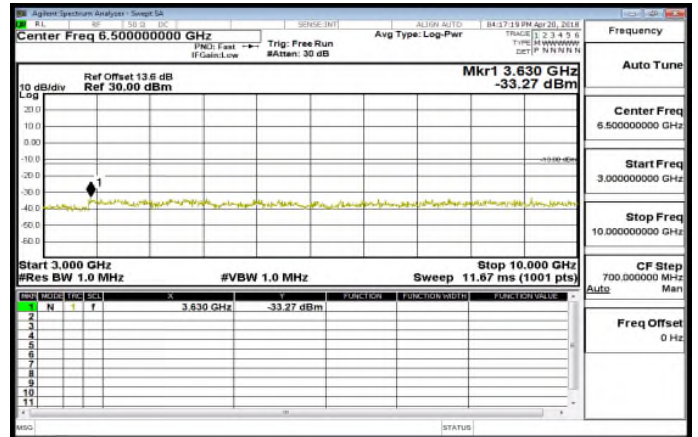
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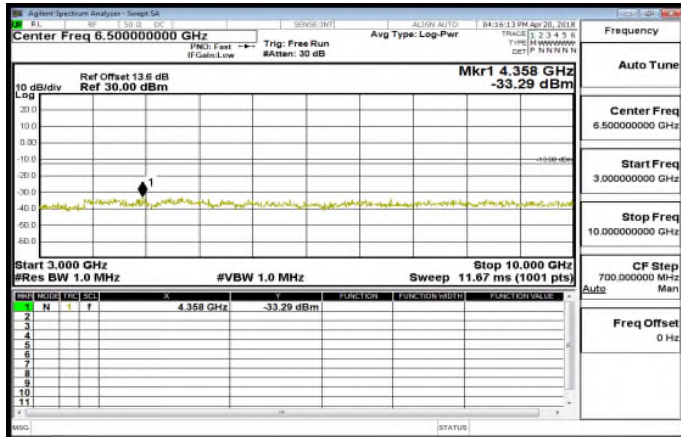
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5-779.5



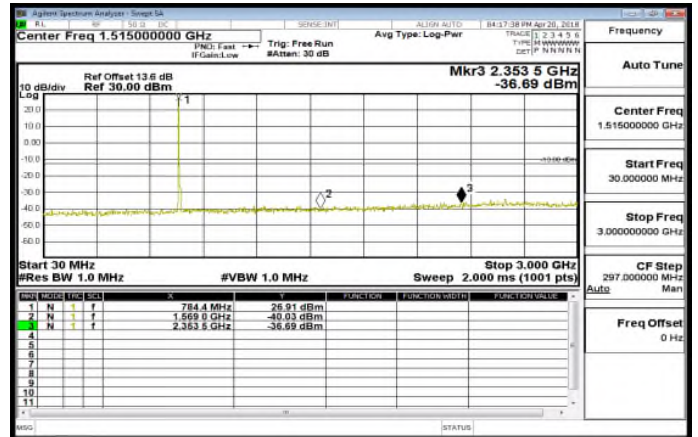
3GHz~10GHz_Band13_5MHz_QPSK_1_0_MidCH2323
0-782



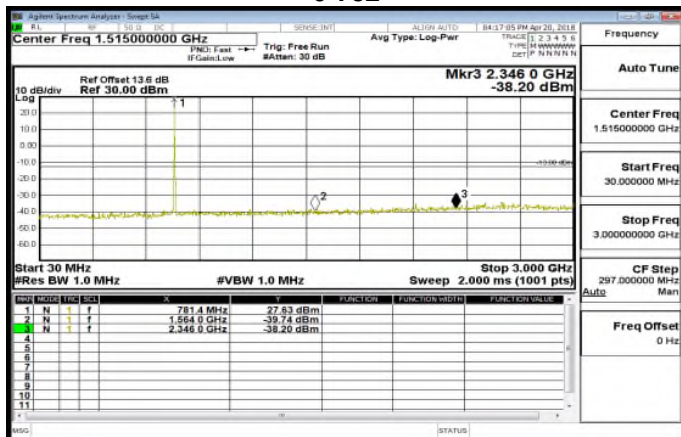
3GHz~10GHz_Band13_5MHz_QPSK_1_0_LowCH2320
5-779.5



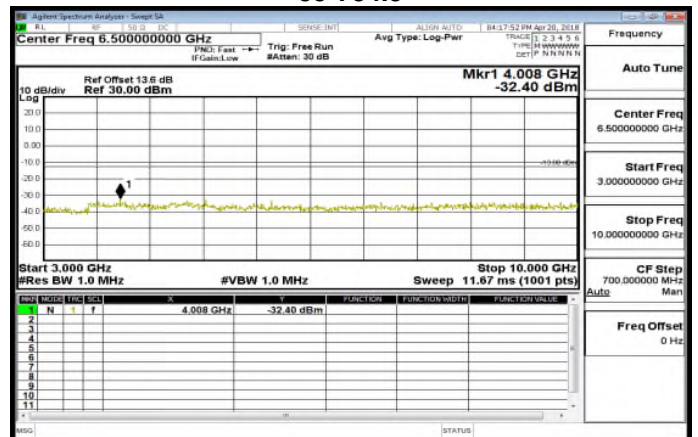
30MHz~3GHz_Band13_5MHz_QPSK_1_0_HighCH232
55-784.5



30MHz~3GHz_Band13_5MHz_QPSK_1_0_MidCH2323
0-782



3GHz~10GHz_Band13_5MHz_QPSK_1_0_HighCH232
55-784.5

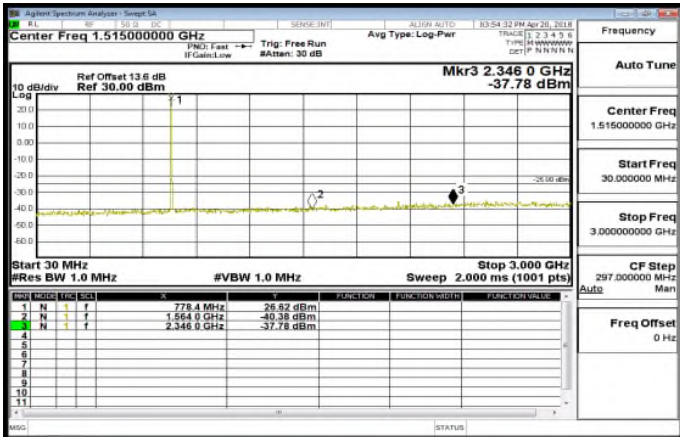


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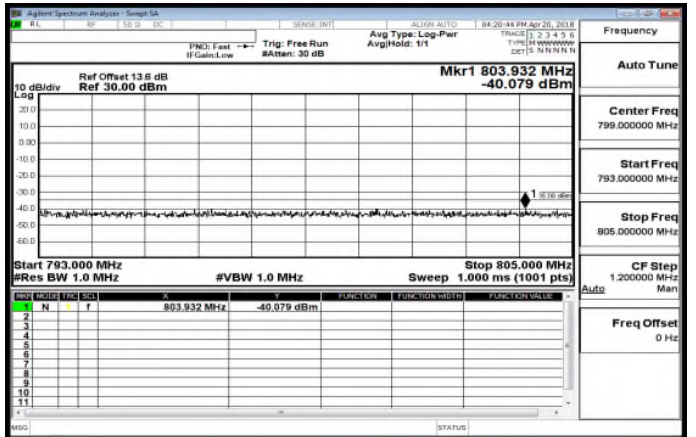
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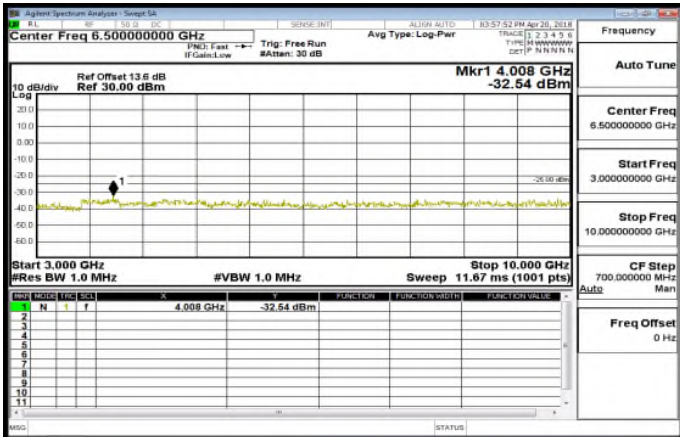
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30-782



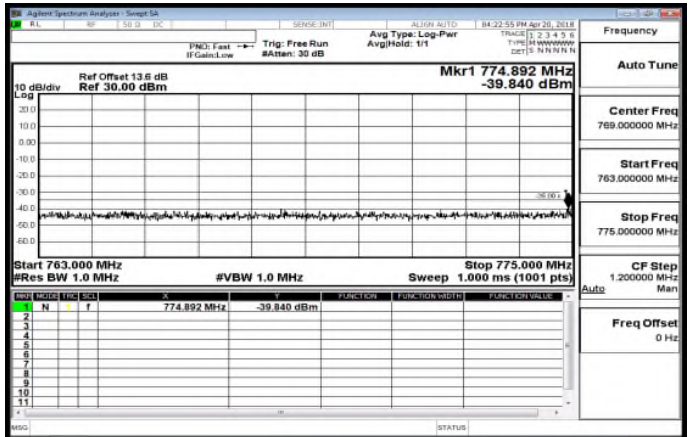
793MHz~805MHz_Band13_5MHz_QPSK_1_0_LowCH
23205-779.5



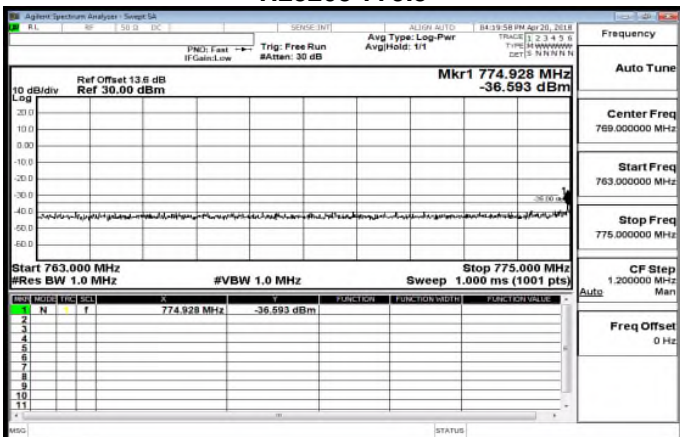
3GHz~10GHz_Band13_10MHz_QPSK_1_0_MidCH232
30-782



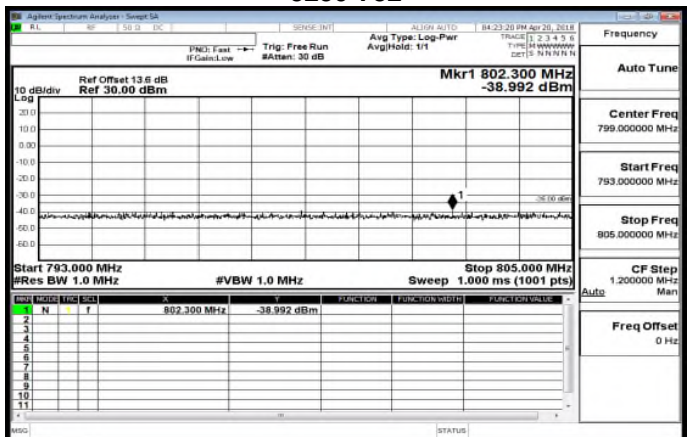
763.3MHz~775MHz_Band13_5MHz_QPSK_1_0_MidC
H23230-782



763.3MHz~775MHz_Band13_5MHz_QPSK_1_0_LowC
H23205-779.5



793MHz~805MHz_Band13_5MHz_QPSK_1_0_MidCH2
3230-782

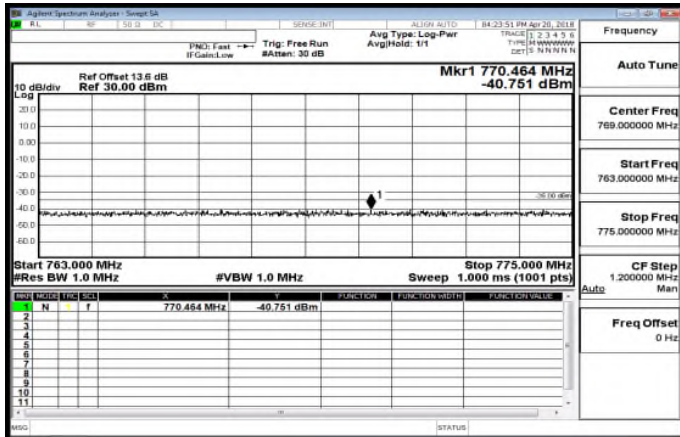


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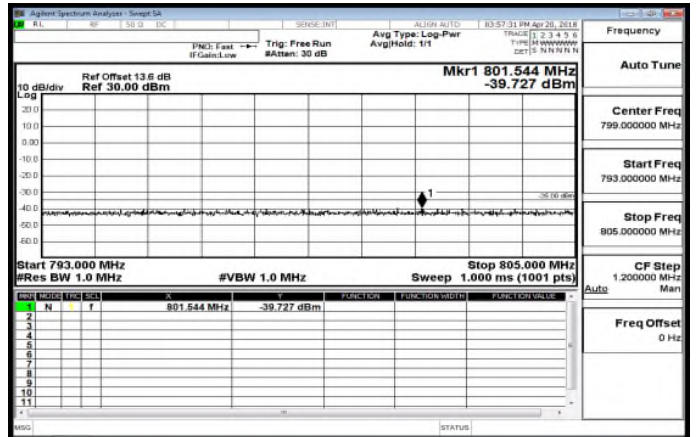
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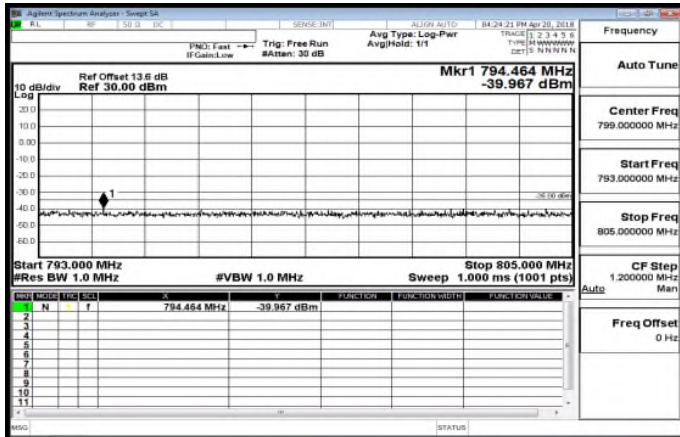
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H23255-784.5



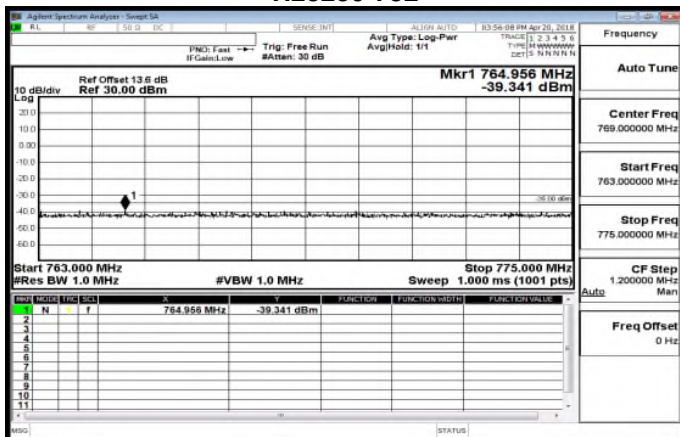
793MHz~805MHz_Band13_10MHz_QPSK_1_0_MidCH
23230-782



793MHz~805MHz_Band13_5MHz_QPSK_1_0_HighCH
23255-784.5



763.3MHz~775MHz_Band13_10MHz_QPSK_1_0_MidC
H23230-782



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