

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION REFERENCING TEST DATA ACROSS SEPARATE EQUIPMENT VERIFICATION

OF

Product Name: Smart Phone
FCC ID: APYHRO00254
Report No.: ER/2017/C0130
Issue Date: Dec. 27, 2017
FCC Rule Part: §15.247, Cat: DSS & DTS
§15.225
Prepared for: Sharp Corporation, IoT Communication B.U.
2-13-1, Hachihonmatsu-lida, Higashi-hiroshima-shi, Hiroshima 739-0192, Japan
Manufacturer: Sharp Corporation
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SGS Taiwan Ltd.
Prepared by: Electronics & Communication Laboratory
No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803



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VERIFICATION OF COMPLIANCE

Applicant: Sharp Corporation, IoT Communication B.U.
2-13-1, Hachihonmatsu-lida, Higashi-hiroshima-shi, Hiroshima
739-0192, Japan

Manufacturer: Sharp Corporation
1 Takumi-cho, Sakai-ku, Sakai-Shi, Osaka 590-8522, Japan

Product Name: Smart Phone

FCC ID: APYHRO00254

File Number: ER/2017/C0130

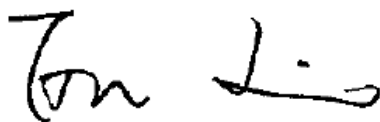
Date of test: Dec. 12, 2017 ~ Dec. 21, 2017

Date of EUT Received: Dec. 12, 2017

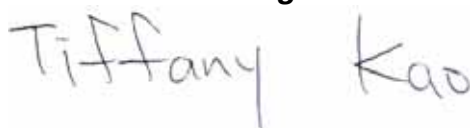
We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2013 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.

Test By:**Date:**

Dec. 21, 2017

Tin Lin / Engineer**Prepared By:****Date:**

Dec. 21, 2017

Tiffany Kao / Clerk**Approved By:****Date:**

Dec. 21, 2017

Jim Chang / Asst. Manager

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Revision History

Report Number	Revision	Description	Issue Date
ER/2017/C0130	Rev.00	Initial creation of document	Dec. 21, 2017

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1 GENERAL INFORMATION

1.1 Product description

General:

Product Name:	Smart Phone	
Hardware Version:	DVT	
Software Version:	A809G	
Power Supply:	3.85V from Rechargeable Li-ion Battery	
	Battery:	Mode No.: UBATIA283AFN2, Supplier: SCUD(FUJIAN) Electronics Co., Ltd.

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1.2 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247

FCC KDB 558074 D01 v04 DTS Meas. Guidance

ANSI C63.10:2013

FCC Part 15, Subpart C §15.225

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

1.3 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.134, Wu Kung Road,
New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803

(TAF code 0513)

FCC Registration Number and Designation number are: 509634 / TW0001

1.4 Special Accessories

There are no special accessories used while test was conducted.

1.5 Equipment Modifications

There was no modification 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

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme.

2.3 Test Procedure

2.3.1 Radiated Emissions for DSS & DTS

The EUT is placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference 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 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.

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2.4 Configuration of Tested System

Fig. 2-1 Radiated Emission Configuration (BT & BLE & WLAN)



Fig. 2-2 Radiated Emission Configuration (NFC)



Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	Bluetooth Test Software	N/A	N/A	N/A	N/A	N/A
2.	WLAN Test Software	N/A	N/A	N/A	N/A	N/A
3.	Notebook	Lenovo	L430	P0000081	Shielded	Unshielded

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3 SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.247(d)	Radiated Spurious Emission	Compliant
§2.1053 §24.238(a)	Field Strength of Spurious Radiation	Compliant
§15.225 (a)-(d)	Radiated Emission	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. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.
3. Investigation has been done base on the worst case of original FCC ID: APYHRO00251 for DSS, DTS and NFC.

RADIATED EMISSION TEST:

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	Worst Case Position H / E1 / E2
Bluetooth	78	78	8-DPSK	3DH5	H
Bluetooth LE	39	39	GFSK	1	H
802.11b	11	11	DSSS	1	H
802.11g	11	11	OFDM	6	H
802.11n (HT20)	11	11	OFDM	MCS 0	H
NFC	1	1	ASK	N/A	H

Note:

The field strength of radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for BT, BLE, WLAN and NFC Transmitter for channel Low, Mid and High, the worst case position was reported.

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5 MEASUREMENT UNCERTAINTY

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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6 RADIATED SPURIOUS EMISSION MEASUREMENT

6.1 Measurement Equipment Used:

SGS SAC-III					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EMI Test Receiver	R&S	ESCI7	100760	05/11/2017	05/10/2018
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/25/2017	04/24/2018
Loop Antenna	ETS-Lindgren	6502	148045	09/20/2017	09/19/2018
Bilog Antenna	SCHWAZBECK	VULB9168	378	12/19/2017	12/18/2018
Horn Antenna	Schwarzbeck	BBHA9120D	1441	08/04/2017	08/03/2018
Pre-Amplifier	Agilent	8447D	2944A07676	01/03/2017	01/02/2018
Pre-Amplifier	EMC Instruments Corp.	EMC0126530	980038	01/03/2017	01/02/2018
Turn Table	HD	DT420	N/A	N.C.R	N.C.R
Antenna Tower	ChamPro	AM-BS-4500-B	060776-ABS	N.C.R	N.C.R
Controller	ChamPro	EM1000	60776	N.C.R	N.C.R
Low Loss Cable	Huber Suhner	966_RX	9	01/05/2017	01/04/2018
3m Site NSA	SGS	966 chamber	N/A	07/01/2017	06/30/2018
Low Loss Cable	Huber Suhner	966 TX	1	01/05/2017	01/04/2018
Horn Antenna	Schwarzbeck	BBHA9170	184	12/12/2017	12/11/2018
Pre-Amplifier	EMC Instruments Corp.	EMC184045	980135	01/05/2017	01/04/2018

Note: N.C.R refers to Not Calibrated Required.

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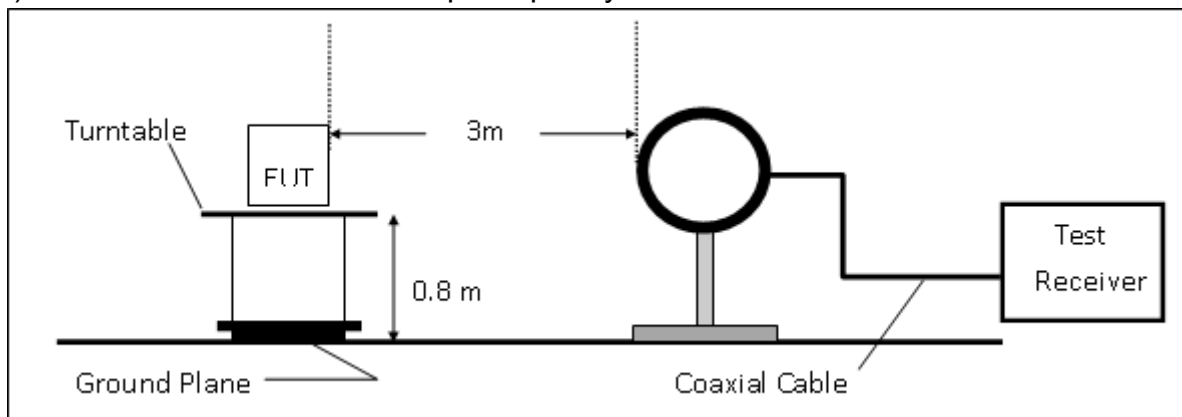
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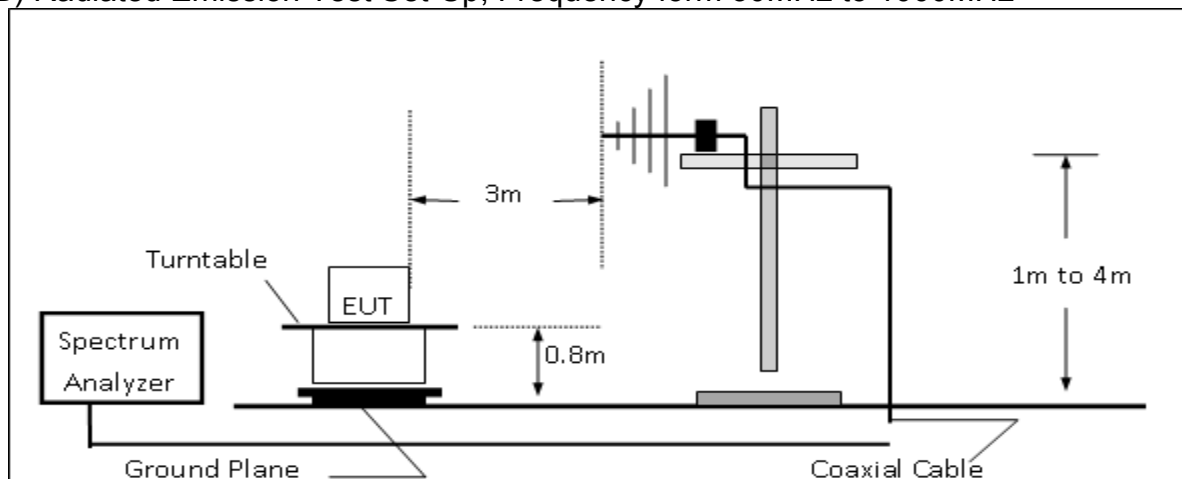
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6.2 Test SET-UP

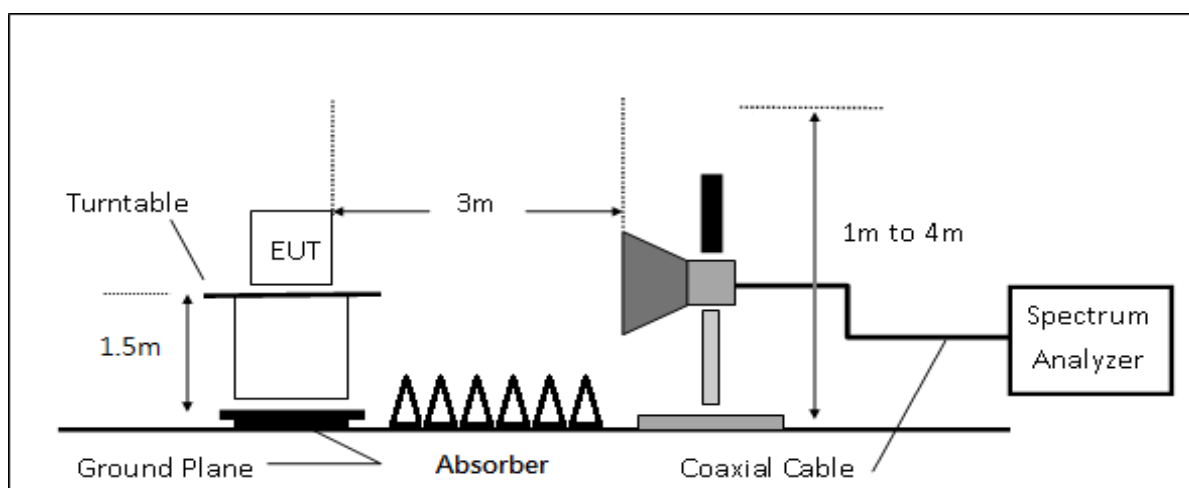
(A) Radiated Emission Test Set-Up Frequency Below 30MHz.



(B) Radiated Emission Test Set-Up, Frequency form 30MHz to 1000MHz



(C) Radiated Emission Test Set-Up Frequency Over 1 GHz



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6.3 Measurement Procedure

1. Configure the EUT according to ANSI C63.10.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
3. The EUT was placed on a turn table with 1.5m for frequency > 1GHz above ground plane.
4. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
5. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
6. 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.
7. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Peak Detector at frequency above 1 GHz.
8. Set the spectrum analyzer as RBW=1 MHz, VBW=10 Hz (Duty cycle > 98%) or VBW ≥ 1/T (Duty cycle < 98%) for Average Detector at frequency above 1 GHz.
9. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
10. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. On spectrum, change spectrum mode in linear display mode, and reduce VBW = 10Hz if average reading is measured.
11. Repeat above procedures until all default test channel measured were complete.

6.4 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	

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note :

“F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

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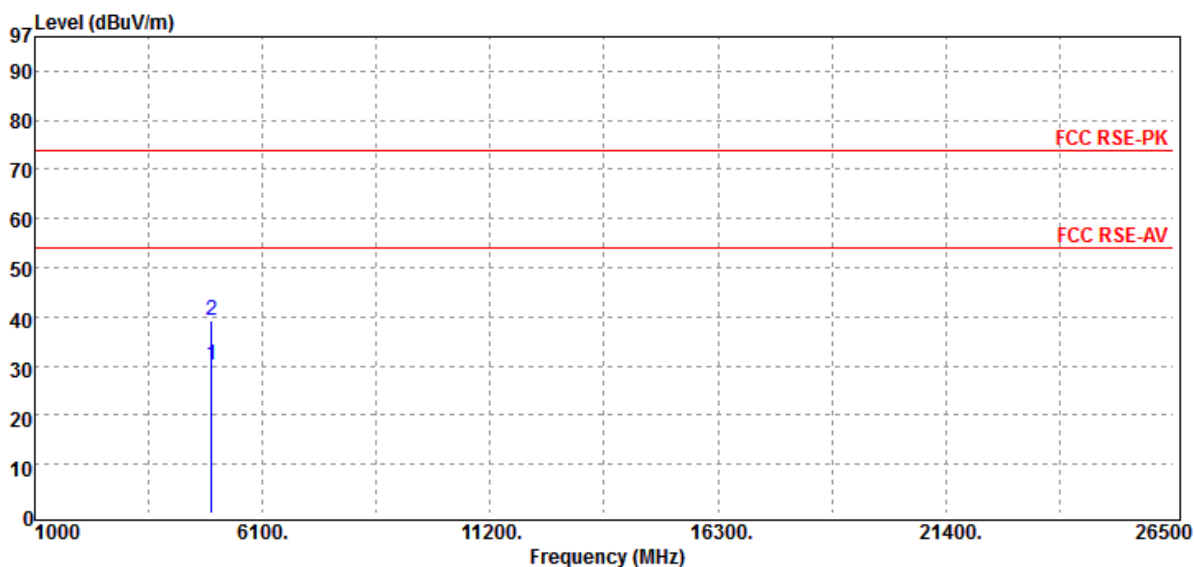
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6.5 Measurement Result

Operation Band	:EDR(3M)	Test Date	:2017-12-15
Fundamental Frequency	:2480 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Tx CH HIGH	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4960.00	H	Average	24.77	5.29	30.06	54.00	-23.94
4960.00	H	Peak	33.93	5.29	39.22	74.00	-34.78

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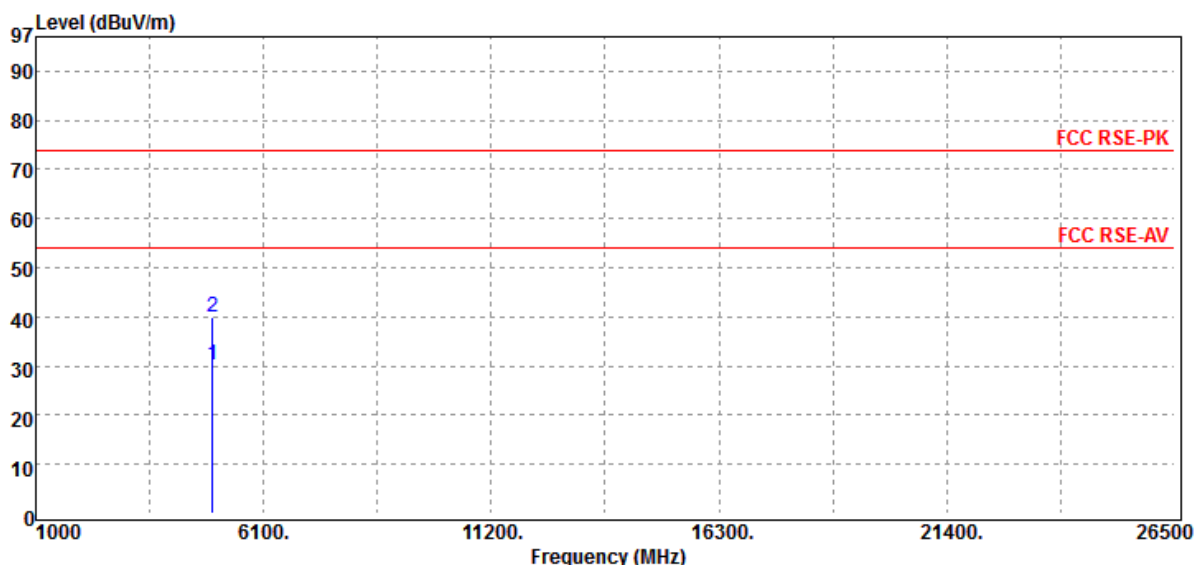
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Operation Band	:EDR(3M)	Test Date	:2017-12-15
Fundamental Frequency	:2480 MHz	Temp./Humi.	:23 deg_C / 62 RH
Operation Mode	:Tx CH HIGH	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4960.00	H	Average	24.98	5.29	30.27	54.00	-23.73
4960.00	H	Peak	34.67	5.29	39.96	74.00	-34.04

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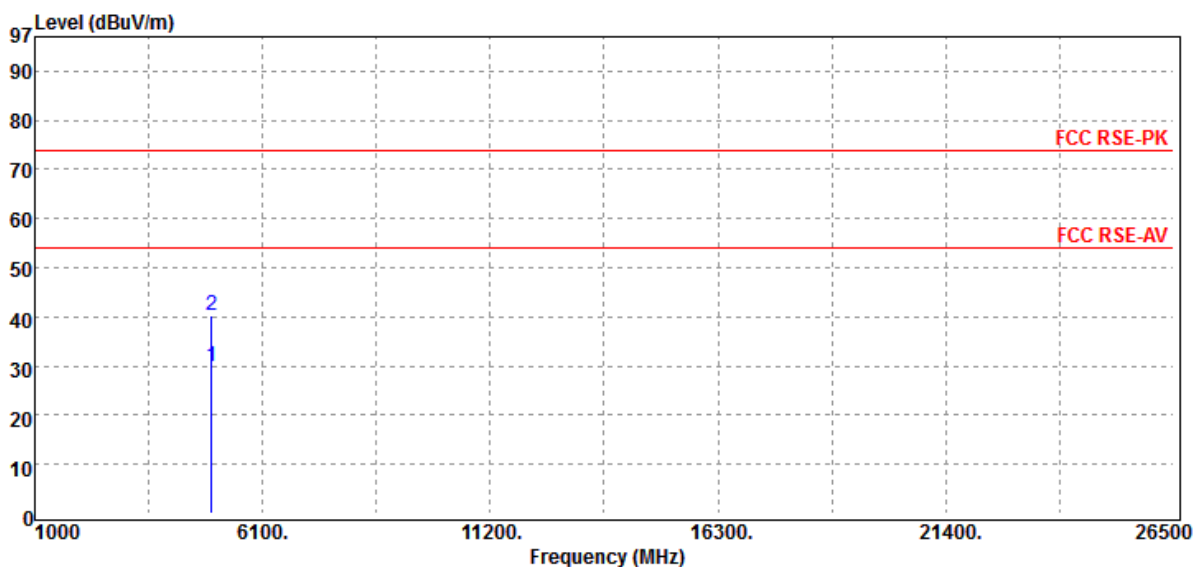
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Operation Band	:BLE	Test Date	:2017-12-15
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH HIGH	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4960.00	H	Average	24.66	5.29	29.95	54.00	-24.05
4960.00	H	Peak	34.86	5.29	40.15	74.00	-33.85

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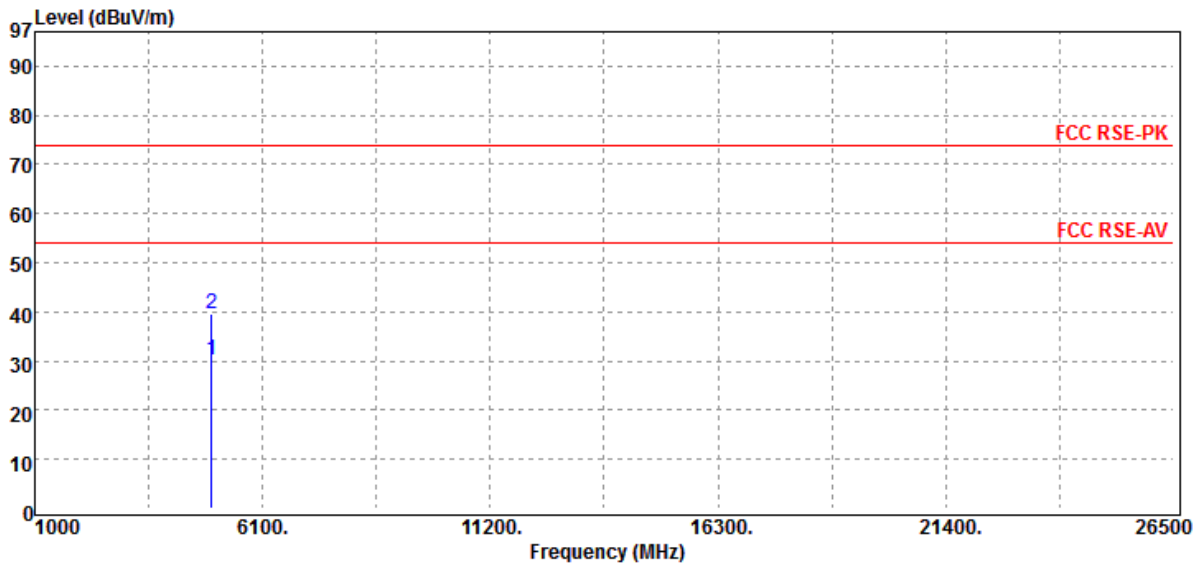
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Operation Band	:BLE	Test Date	:2017-12-15
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Tx CH HIGH	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4960.00	H	Average	25.02	5.29	30.31	54.00	-23.69
4960.00	H	Peak	34.44	5.29	39.73	74.00	-34.27

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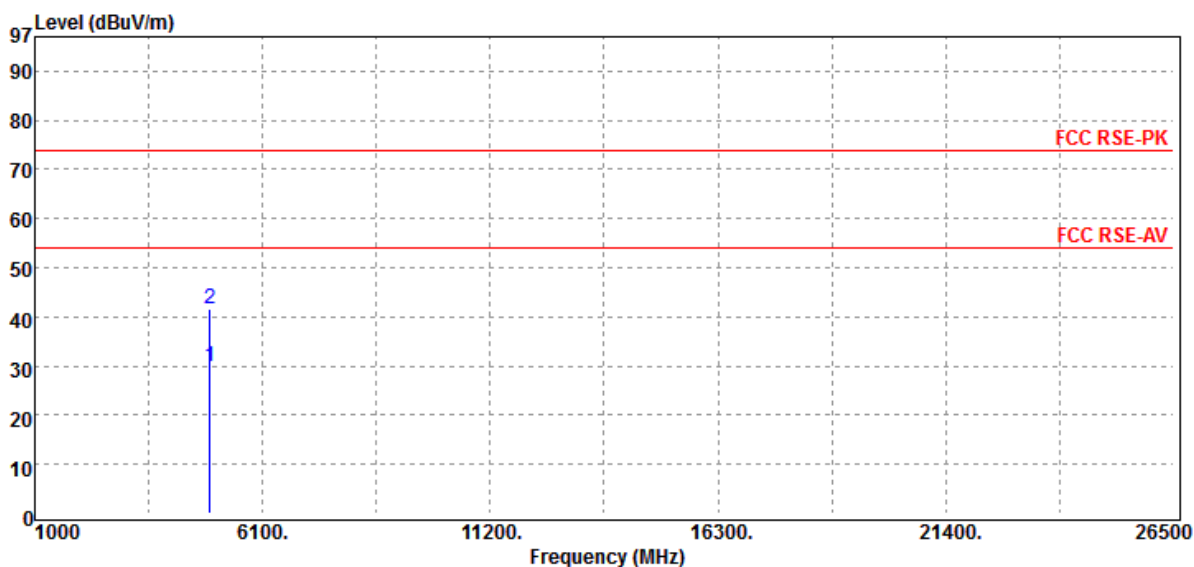
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Operation Band	:802.11b	Test Date	:2017-12-15
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH HIGH	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4924.00	H	Average	24.49	5.25	29.74	54.00	-24.26
4924.00	H	Peak	36.33	5.25	41.58	74.00	-32.42

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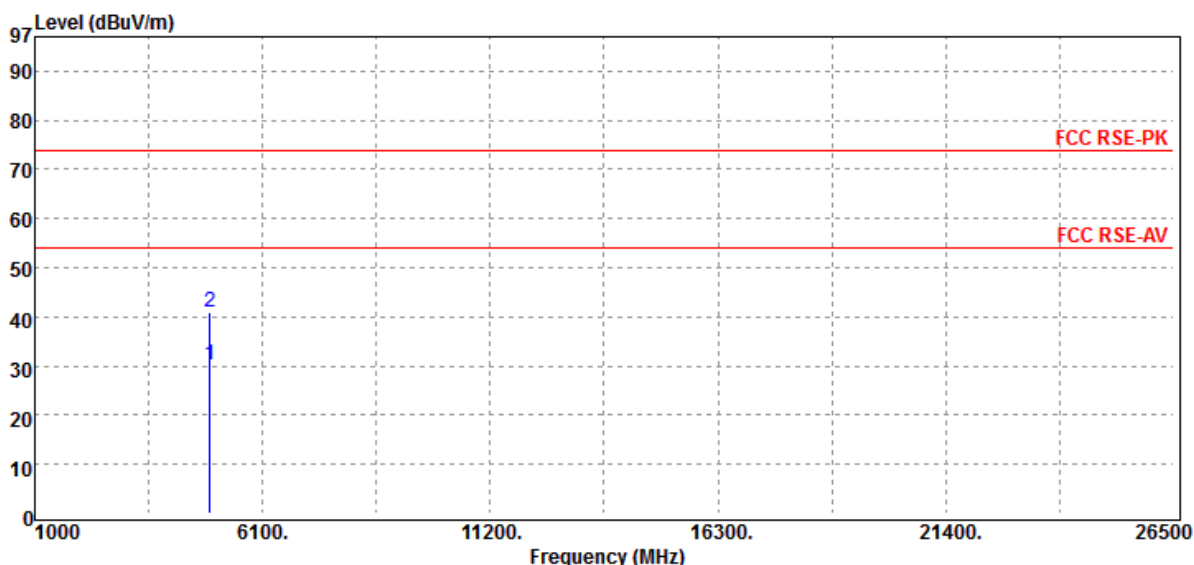
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Operation Band	:802.11b	Test Date	:2017-12-15
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH HIGH	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4924.00	H	Average	24.82	5.25	30.07	54.00	-23.93
4924.00	H	Peak	35.75	5.25	41.00	74.00	-33.00

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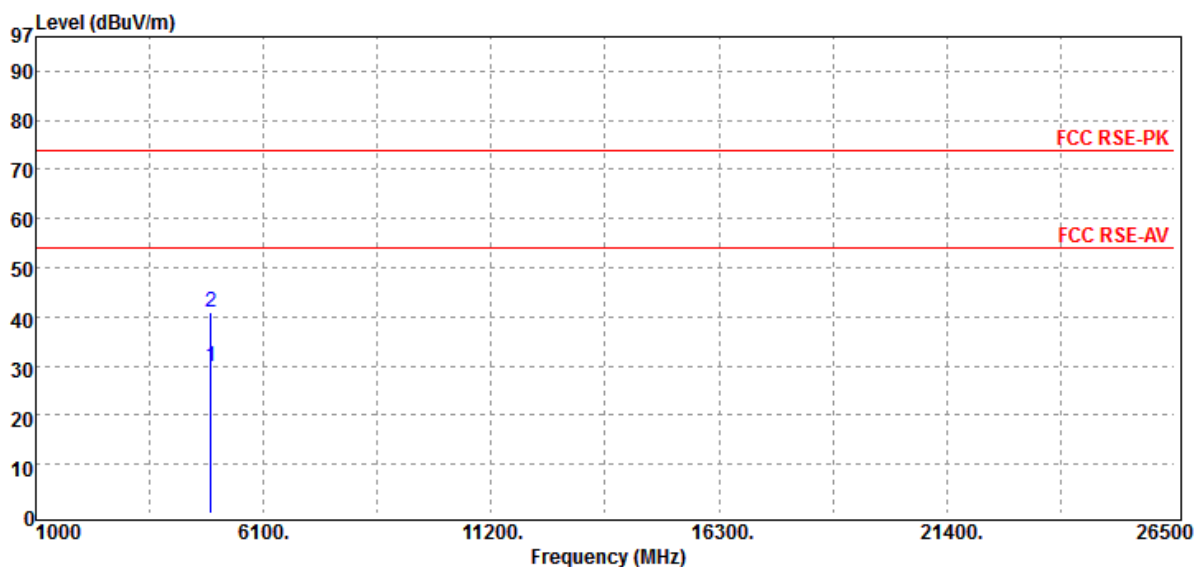
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Operation Band	:802.11g	Test Date	:2017-12-15
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH HIGH	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
MHz	F/H/E/S	Mode	Reading Level		FS	@3m	Margin
		PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4924.00	H	Average	24.69	5.25	29.94	54.00	-24.06
4924.00	H	Peak	35.63	5.25	40.88	74.00	-33.12

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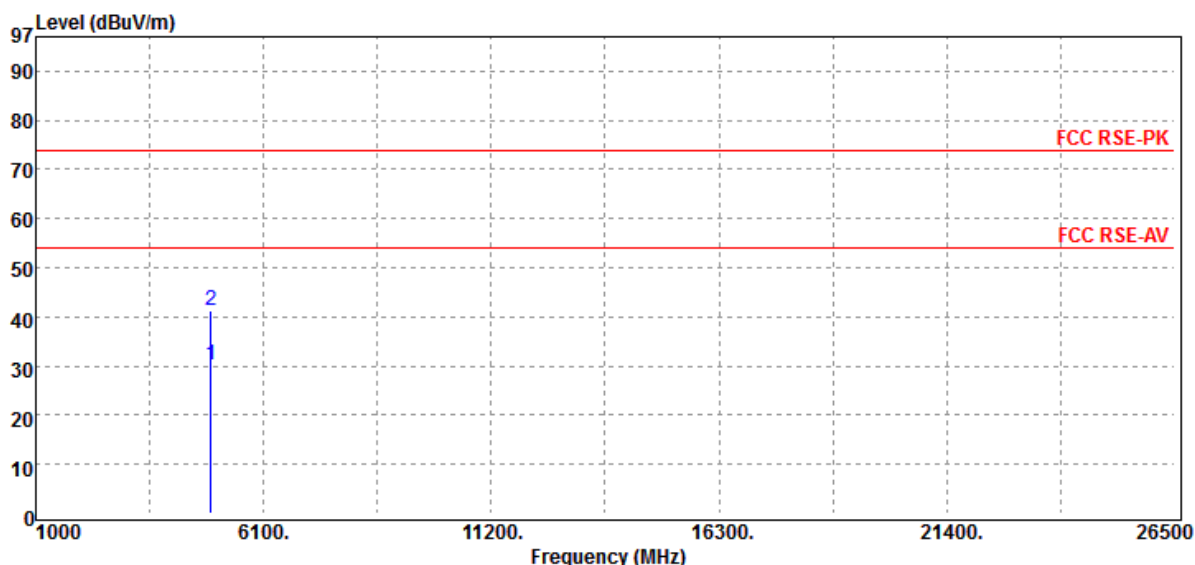
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Operation Band	:802.11g	Test Date	:2017-12-15
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH HIGH	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4924.00	H	Average	25.08	5.25	30.33	54.00	-23.67
4924.00	H	Peak	35.94	5.25	41.19	74.00	-32.81

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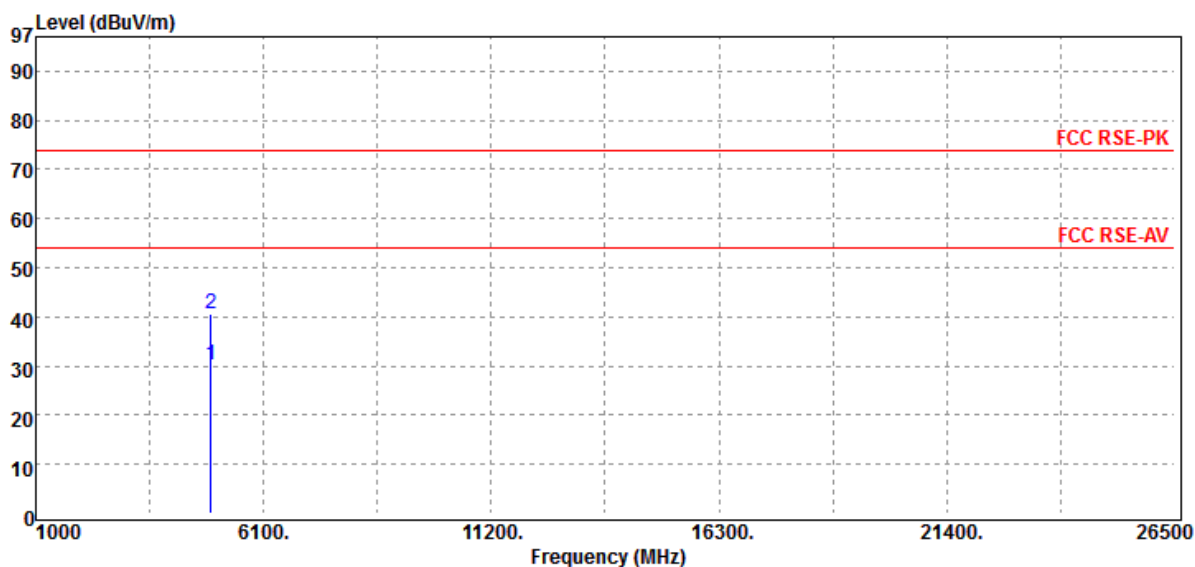
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Operation Band	:802.11n20	Test Date	:2017-12-15
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH HIGH	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4924.00	H	Average	24.85	5.25	30.10	54.00	-23.90
4924.00	H	Peak	35.38	5.25	40.63	74.00	-33.37

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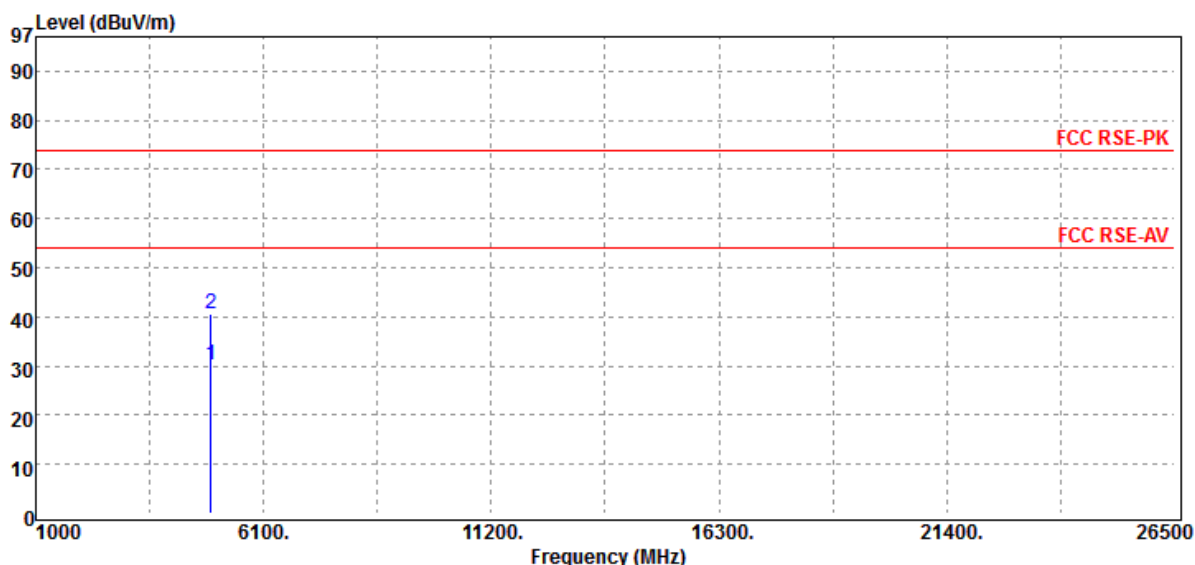
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Operation Band	:802.11n20	Test Date	:2017-12-15
Fundamental Frequency	:2462 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH HIGH	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Safe
		Mode	Reading Level		FS	@3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4924.00	H	Average	25.09	5.25	30.34	54.00	-23.66
4924.00	H	Peak	35.51	5.25	40.76	74.00	-33.24

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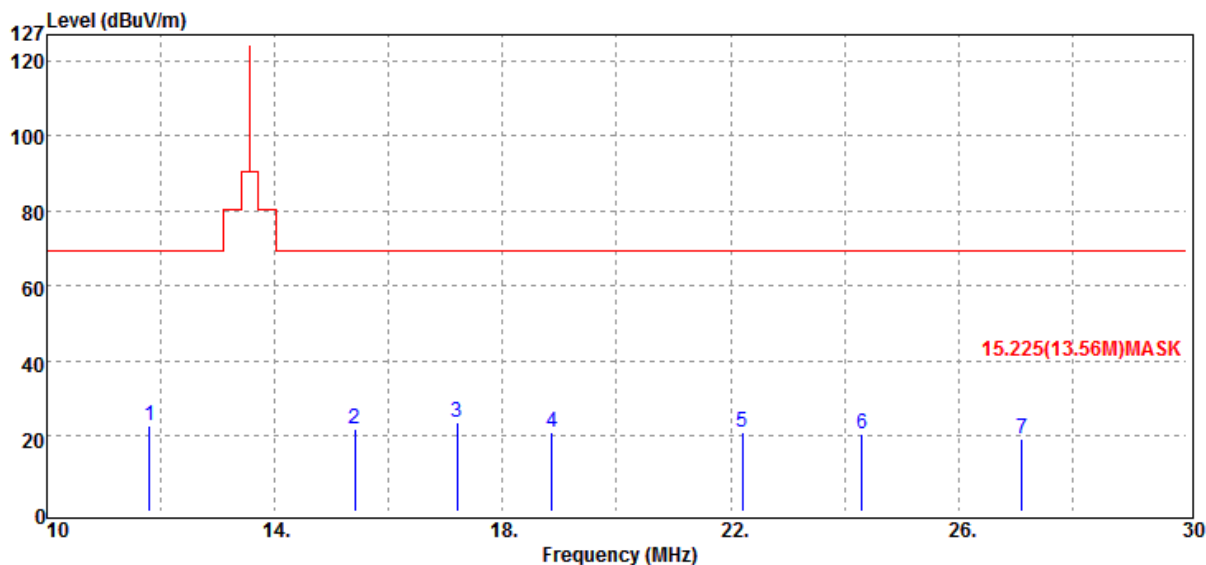
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Operation Band	:NFC	Test Date	:2017-12-15
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
11.80	S	Peak	11.61	11.39	23.00	69.54	-46.54
15.40	S	Peak	10.42	11.47	21.89	69.54	-47.65
17.20	S	Peak	12.25	11.52	23.77	69.54	-45.77
18.86	S	Peak	9.52	11.56	21.08	69.54	-48.46
22.20	S	Peak	10.37	10.92	21.29	69.54	-48.25
24.30	S	Peak	10.09	10.37	20.46	69.54	-49.08
27.12	H	Peak	9.59	9.70	19.29	69.54	-50.25

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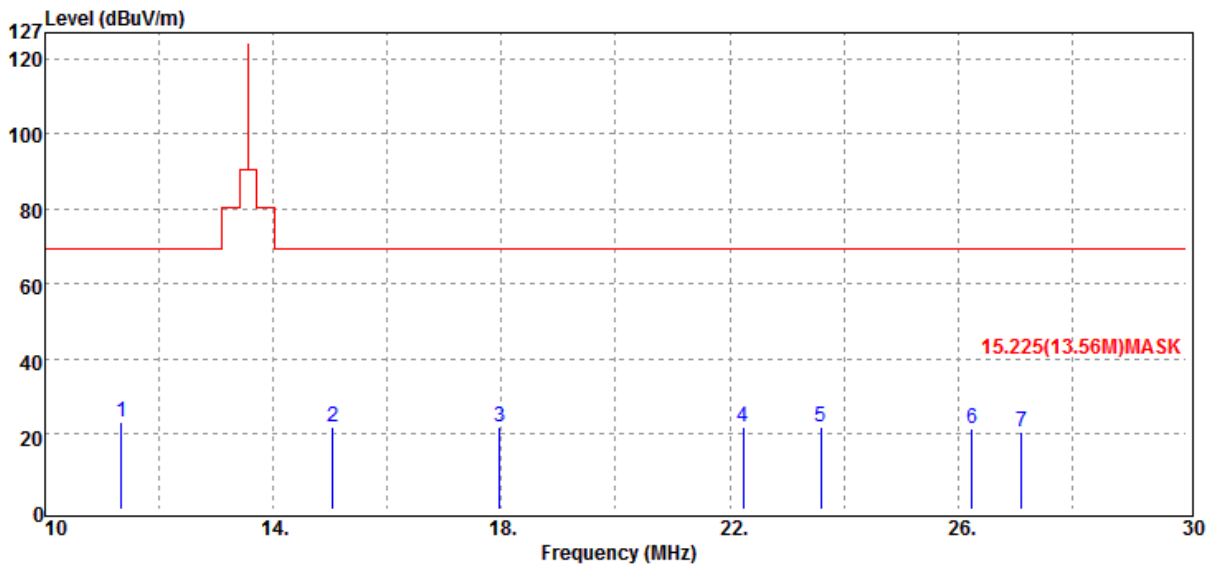
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Operation Band	:NFC	Test Date	:2017-12-15
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
		PK/QP/AV	dBμV		dBμV/m	dBμV/m	
11.34	S	Peak	11.95	11.38	23.33	69.54	-46.21
15.04	S	Peak	10.51	11.47	21.98	69.54	-47.56
17.96	S	Peak	10.60	11.53	22.13	69.54	-47.41
22.24	S	Peak	11.13	10.91	22.04	69.54	-47.50
23.60	S	Peak	11.27	10.55	21.82	69.54	-47.72
26.24	S	Peak	11.81	9.90	21.71	69.54	-47.83
27.12	H	Peak	10.88	9.70	20.58	69.54	-48.96

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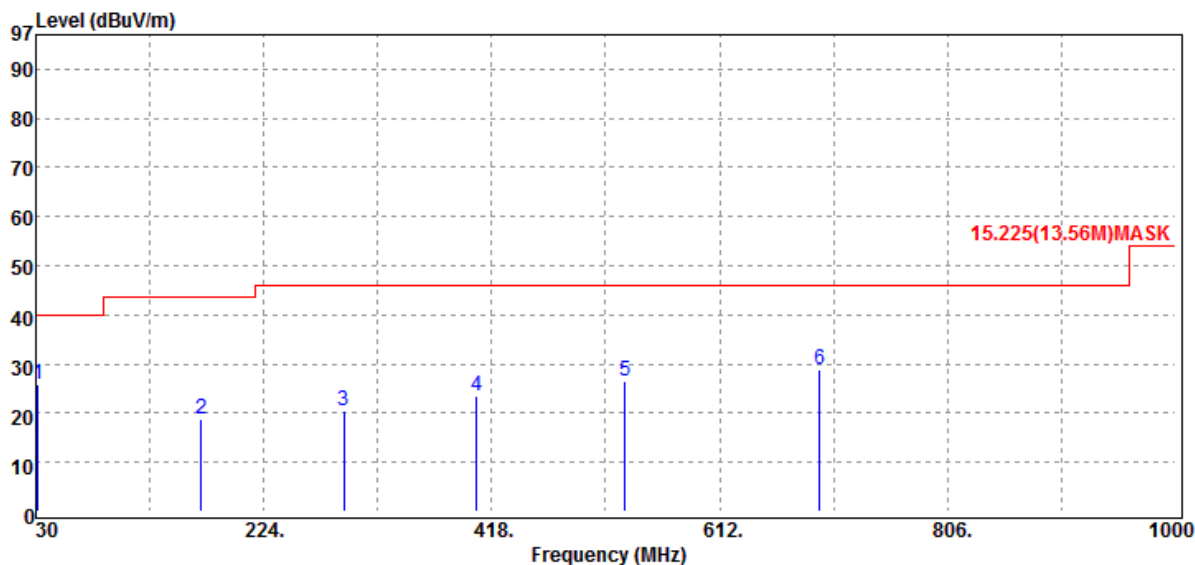
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Operation Band :NFC
Fundamental Frequency :13.56 MHz
Operation Mode :Tx CH MID
EUT Pol. :H Plane

Test Date :2017-12-15
Temp./Humi. :21 deg_C / 62 RH
Engineer :Tin
Measurement Antenna Pol. :VERTICAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
		PK/QP/AV	dB μ V		dB μ V/m	dB μ V/m	
31.94	S	Peak	34.86	-9.11	25.75	40.00	-14.25
170.65	S	Peak	26.58	-7.66	18.92	43.50	-24.58
291.90	S	Peak	26.57	-6.08	20.49	46.00	-25.51
405.39	S	Peak	27.11	-3.70	23.41	46.00	-22.59
531.49	S	Peak	28.03	-1.57	26.46	46.00	-19.54
697.36	S	Peak	27.35	1.36	28.71	46.00	-17.29

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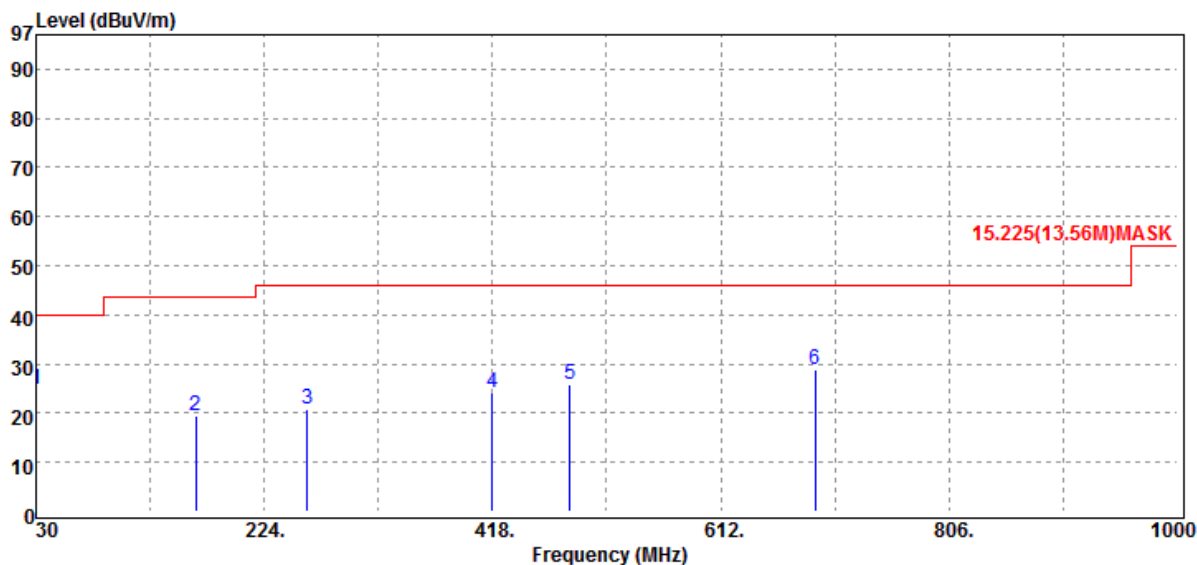
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Operation Band	:NFC	Test Date	:2017-12-15
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:Tx CH MID	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
		PK/QP/AV	dB μ V		dB μ V/m	dB μ V/m	
30.00	S	Peak	33.91	-9.19	24.72	40.00	-15.28
165.80	S	Peak	26.85	-7.40	19.45	43.50	-24.05
260.86	S	Peak	28.06	-7.24	20.82	46.00	-25.18
418.00	S	Peak	27.39	-3.37	24.02	46.00	-21.98
483.96	S	Peak	28.19	-2.47	25.72	46.00	-20.28
692.51	S	Peak	27.25	1.47	28.72	46.00	-17.28

~ End of Report ~

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