

FCC PART 15 SUBPART C TEST REPORT

FCC PART 15.247

Report Reference No	MWR160100404 2AAJDE545	
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Applicant's name	HYUNDAI CORPORATION	
Address:	140-2, Kye-dong, Chongro-ku, Se	oul, South Korea
Test specification:		
Standard:	FCC Part 15.247: Operation wit 2400-2483.5 MHz and 5725-5850	hin the bands 902-928 MHz, MHz
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Test item description	Mobile Phone	
Trade Mark	HYUNDAI	
Manufacturer	Shenzhen Rainbow Time Techn	ology Co.,Ltd
Model/Type reference	E545	
Listed Models	1	
Modulation Type	GFSK	
Operation Frequency	From 2402MHz to 2480MHz	
Rating	DC 3.80V	
Hardware version	14900_MM1_V03	
Software version	HYUNDAI_E545_V5.1.1_2016012	22
Result	PASS	

TEST REPORT

Test Report No. :	MWR160100404		Jan. 24, 2016	
			Date of issue	
		Mahila Dhana		
Equipment under Test	:	Mobile Phone		
Model /Type	:	E545		
Listed Models	:	1		
	-			
Applicant	:	HYUNDAI CORPORAT	ION	
Address	:	140-2, Kye-dong, Chong	gro-ku, Seoul, South Korea	
Manufacturar		Shanzhan Bainhaw Tir	na Taabaalagu Ca I ta	
manufacturer	-	Snenznen Raindow Hr	ne rechnology Co.,Lta	
Address	:	Room 905, ChangHong Technology Park, Nansł	Technology Building, Science and nan District, Shenzhen, China	

Test Result:	PASS

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

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1 <u>TEST STANDARDS</u>

The tests were performed according to following standards:

<u>FCC Rules Part 15.247:</u> Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz <u>ANSI C63.10:2013</u>: American National Standard for Testing Unlicensed Wireless Devices <u>KDB558074 D01 V03:</u> Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

2 <u>SUMMARY</u>

2.1 General Remarks

Date of receipt of test sample	:	Jan. 01, 2016
Testing commenced on	:	Jan. 12, 2016
Testing concluded on	:	Jan. 24, 2016

2.2 Product Description

The **HYUNDAI CORPORATION**'s Model: E545 or the "EUT" as referred to in this report; more general information as follows, for more details, refer to the user's manual of the EUT.

Name of EUT	Mobile Phone
Model Number	E545
Modilation Type	GMSK for GSM/GPRS, 8-PSK for EDGE,QPSK for UMTS
Antenna Type	Internal
UMTS Operation Frequency Band	Device supported UMTS FDD Band II/V
	IEEE 802.11b:2412-2462MHz
	IEEE 802.11g:2412-2462MHz
WEAN FCC Operation frequency	IEEE 802.11n HT20:2412-2462MHz
	IEEE 802.11n HT40:2422-2452MHz
BT FCC Operation frequency	2402MHz-2480MHz
HSDPA Release Version	Release 10
HSUPA Release Version	Release 6
DC-HSUPA Release Version	Not Supported
WCDMA Release Version	R99
	IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK)
WI AN ECC Modulation Type	IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK)
WEAN FEE Modulation Type	IEEE 802.11n HT20: OFDM (64QAM, 16QAM, QPSK,BPSK)
	IEEE 802.11n HT40: OFDM (64QAM, 16QAM, QPSK,BPSK)
BT Modulation Type	GFSK,8DPSK,π/4DQPSK(BT 3.0+EDR)
Hardware version	14900_MM1_V03
Software version	HYUNDAI_E545_V5.1.1_20160122
Android version	Android 4.4.2
GPS function	Supported
WLAN	Supported 802.11b/802.11g/802.11n
Bluetooth	Supported BT 4.0/BT 3.0+EDR
GSM/EDGE/GPRS	Supported GSM/GPRS/EDGE
GSM/EDGE/GPRS Power Class	GSM850:Power Class 4/ PCS1900:Power Class 1
GSM/EDGE/GPRS Operation	COM850 :824 2MH- 848 8MH-/DCC1000:1850 2MH- 1000 8MH-
Frequency	G310050 .024.210102-040.010102/PC3 1900. 1050.210102-1909.010102
GSM/EDGE/GPRS Operation	
Frequency Band	G3W650/FC31900/GFR3650/GFR31900/EDGE650/EDGE1900
GSM Release Version	R99
GPRS/EDGE Multislot Class	GPRS/EDGE: Multi-slot Class 12
Extreme temp. Tolerance	-30°C to +50°C
Extreme vol. Limits	3.40VDC to 4.20VDC (nominal: 3.80VDC)
GPRS operation mode	Class B

2.3 Equipment Under Test

Power supply system utilised

Power supply voltage	:	0	120V / 60 Hz	0	115V / 60Hz
		0	12 V DC	0	24 V DC
		•	Other (specified in blank below))

DC 3.80V

2.4 Description of the test mode

The application provider specific test software to control sample in continuous TX and RX (Duty Cycle >98%)

For testing meet KDB558074 test requirement.

The EUT has been tested under typical operating condition. The Applicant provides communication tools software to control the EUT for staying in continuous transmitting and receiving mode for testing. There are 40 channels of EUT, and the test carried out at the lowest channel, middle channel and highest channel

Channel	Frequency(MHz)	Channel	Frequency(MHz)
00	2402	20	2442
01	2404	21	2444
02	2406	22	2446
03	2408	23	2448
04	2410	24	2450
05	2412	25	2452
06	2414	26	2454
07	2416	27	2456
08	2418	28	2458
09	2420	29	2460
10	2422	30	2462
11	2424	31	2464
12	2426	32	2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
18	2438	38	2478
19	2440	39	2480

2.5 Short description of the Equipment under Test (EUT)

2.5.1 General Description

E545 is subscriber equipment in the WCDMA/GSM system. The HSPA/UMTS frequency band is Band I,Band II, Band Vand Band VIII; The GSM/GPRS/EDGE frequency band includes GSM850 and GSM900 and DCS1800 and PCS1900, but only Band II and Band V and GSM850 and PCS1900 bands test data included in this report. The Mobile Phone implements such functions as RF signal receiving/transmitting, HSPA/UMTS and GSM/GPRS/EDGE protocol processing, voice, video MMS service, GPS and WIFI etc. Externally it provides micro SD card interface, earphone port (to provide voice service) and SIM card interface. It also provides Bluetooth module to synchronize data between a PC and the phone, or to use the built-in modem of the phone to access the Internet with a PC, or to exchange data with other Bluetooth devices

NOTE: Unless otherwise noted in the report, the functional boards installed in the units shall be selected from the below list, but not means all the functional boards listed below shall be installed in one unit.

Note: The EUT was programmed to be in continuously transmitting mode and the transmit duty cycle is not less than 98%.

2.5.2 Customized Configurations

#EUT Conf.	Signal Description	Operating Frequency
TM1_Ch00	GFSK modulation	Ch No. 00/2402MHz
TM1_Ch19	GFSK modulation	Ch No. 19/ 2440MHz
TM1_Ch39	GFSK modulation	Ch No. 39/ 2480MHz

2.6 Test Environments

NOTE: The values used in the test report maybe stringent than the declared.

Environment Parameter	Selected Values During Tests			
	Temperature	Voltage	Relative Humidity	
	Ambient	3.7VDC	Ambient	

2.7 EUT operation mode

The EUT has been tested under typical operating condition. The Applicant provides command

to control the EUT for staying in continuous transmitting (Duty Cycle >98%) and receiving mode for testing.

2.8 EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

- - supplied by the manufacturer
- \bigcirc supplied by the lab

Ο	Power Cable	Length (m) :	/
		Shield :	1
		Detachable :	1
Ο	Multimeter	Manufacturer :	1
		Model No. :	1

2.9 Internal Identification of AE used during the test

AE ID*	Description
AE1	Charger and USB cable

AE1 Model: 811B INPUT: AC100-240V~ 50/60Hz 0.15A OUTPUT: DC 5.0V 1500mA

*AE ID: is used to identify the test sample in the lab internally.

2.10 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: 2AAJDE545 filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

2.11 Modifications

No modifications were implemented to meet testing criteria.

3 <u>TEST ENVIRONMENT</u>

3.1 Address of the test laboratory

Shenzhen CTL Testing Technology Co., Ltd.

Floor 1-A, Baisha Technology Park, No. 3011, Shahexi Road, Nanshan, Shenzhen 518055 China

There is one 3m semi-anechoic chamber and two line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.4, CISPR 22/EN 55022 and CISPR16-4-1 SVSWR requirements.

3.2 Test Facility

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

IC Registration No.: 9618B

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

FCC-Registration No.: 970318

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

3.3 Environmental conditions

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

Temperature:	15-35 ° C
Humidity:	30-60 %
Atmospheric pressure:	950-1050mbar

3.4 Test Description

Test Item	FCC Part No.	Requirements	Verdict
DTS (6 dB) Bandwidth	15.247(a)(2)	≥ 500 kHz.	PASS
Maximum Peak Conducted Output Power	15.247(b)(3)	For directional gain:< 30dBm – (G[dBi] –6 [dB]),peak; Otherwise :< 30dBm, peak.	PASS
Maximum Power Spectral Density Level	15.247(e)	For directional gain :< 8dBm/3 kHz – (G[dBi] –6[dB]), peak. Otherwise :< 8dBm/3 kHz, peak.	PASS
Band Edges Compliance	15.247(d)	< -20dBr/100 kHz if total peak power ≤power limit.	PASS
Unwanted Emissions into Non- Restricted Frequency Bands	15.247(d)	< -20dBr/100 kHz if total peak power ≤power limit.	PASS
Unwanted Emissions into Restricted Frequency Bands (Conducted)	15.247(d) 15.209	< -20dBr/100 kHz if total peak power ≤power limit.	PASS
Unwanted Emissions into Restricted Frequency Bands (Radiated)	15.247(d) 15.209	FCC Part 15.209 field strength limit;	PASS
AC Power Line Conducted Emissions	15.207	FCC Part 15.207 conducted limit;	PASS

Remark: The measurement uncertainty is not included in the test result.

Test Specification clause	Test case	Test Mode	Test Channel	Reco In Re	orded eport	Pass	Fail	NA	NP	Remark
§15.247(b)(4)	Antenna gain	GFSK	⊠ Lowest ⊠ Middle ⊠ Highest	GFSK	⊠ Lowest ⊠ Middle ⊠ Highest					complies
§15.247(e)	Power spectral density	GFSK	⊠ Lowest ⊠ Middle ⊠ Highest	GFSK	⊠ Lowest ⊠ Middle ⊠ Highest	\boxtimes				complies
§15.247(a)(1)	Spectrum bandwidth – 6 dB bandwidth	GFSK	⊠ Lowest ⊠ Middle ⊠ Highest	GFSK	⊠ Lowest ⊠ Middle ⊠ Highest	\boxtimes				complies
§15.247(b)(1)	Maximum output power	GFSK	⊠ Lowest ⊠ Middle ⊠ Highest	GFSK	⊠ Lowest ⊠ Middle ⊠ Highest					complies
§15.247(d)	Band edge compliance conducted	GFSK	⊠ Lowest ⊠ Highest	GFSK	⊠ Lowest ⊠ Highest					complies
§15.205	Band edge compliance radiated	GFSK	⊠ Lowest ⊠ Highest	GFSK	⊠ Lowest ⊠ Highest					complies
§15.247(d)	TX spurious emissions conducted	GFSK	⊠ Lowest ⊠ Middle ⊠ Highest	GFSK	⊠ Lowest ⊠ Middle ⊠ Highest					complies
§15.247(d)	TX spurious emissions radiated	GFSK	⊠ Lowest ⊠ Middle ⊠ Highest	GFSK	⊠ Lowest ⊠ Middle ⊠ Highest					complies
§15.109	RX spurious emissions radiated	-/-	-/-	-/-	-/-					complies
§15.209(a)	TX spurious Emissions radiated < 30 MHz	GFSK	-/-	GFSK	-/-					complies
§15.107(a) §15.207	Conducted Emissions < 30 MHz	GFSK	-/-	GFSK	-/-					complies

3.5 Summary of measurement results

Remark:

The measurement uncertainty is not included in the test result. NA = Not Applicable; NP = Not Performed 1.

2.

3.6 Test Conditions

Tost Casa	Test Conditions	
Test Case	Configuration	Description
	Measurement Method	FCC KDB 558074 §8.2 Option 2
DIS (0 0D) Bandwidth	Test Environment	NTNV
Bandwidth	EUT Configuration	TM1_ Ch00, TM1_ Ch19, TM1_ Ch39
Maximum Back Conducted Output	Measurement Method	FCC KDB 558074§9.1.2
Rower	Test Environment	NTNV
Fower	EUT Configuration	TM1_Ch00, TM1_Ch19, TM1_Ch39
Maximum Dowar Speatral Dapaity	Measurement Method	FCC KDB 558074 §10.2 (peak PSD).
	Test Environment	NTNV
Level	EUT Configuration	TM1_Ch00, TM1_Ch19, TM1_Ch39
Linuanted Emissions into Non	Measurement Method	FCC KDB 558074§11.0
Driwanieu Emissions into Non-	Test Environment	NTNV
Restricted Frequency Bands	EUT Configuration	T TM1_ Ch00, TM1_ Ch19, TM1_ Ch39
Unwanted Emissions into Restricted	Measurement Method	FCC KDB 558074§12.2, Conducted
Frequency Bands (Conducted)		(antenna-port).
	Test Environment	NTNV
	EUT Configuration	TM1_Ch00, TM1_Ch19, TM1_Ch39

Unwanted Emissions into Restricted	Measurement Method	FCC KDB 558074§12.1,Radiated(cabinet/case emissions with Impedance matching for antenna-port).
	EUT Configuration	TM1_Ch00, TM1_Ch19, TM1_Ch39

Tost Casa	Test Conditions			
Test Case	Configuration	Description		
AC Reward in Conducted	Measurement Method	AC mains conducted.		
AC Power Line Conducted	Test Environment	NTNV		
Emissions	EUT Configuration	TM1 Ch19 (Worst Conf.).		

Note: For Radiated Emissions, By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that "Z axis" position was the worst, then the final test was executed the worst condition and test data were recorded in this report.

3.7 Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
LISN	R&S	ENV216	3560.6550.12	2015/06/02	2016/06/01
LISN	R&S	ESH2-Z5	860014/010	2015/06/02	2016/06/01
Bilog Antenna	Sunol Sciences Corp.	JB1	A061713	2015/06/02	2016/06/01
EMI Test Receiver	R&S	ESCI	103710	2015/06/02	2016/06/01
Spectrum Analyzer	Agilent	N9030A	MY49430428	2015/05/21	2016/05/20
Controller	EM Electronics	Controller EM 1000	N/A	2015/05/21	2016/05/20
Horn Antenna	Sunol Sciences Corp.	DRH-118	A062013	2015/05/19	2016/05/18
Active Loop Antenna	SCHWARZBECK	FMZB1519	1519-037	2015/05/19	2016/05/18
Amplifier	Agilent	8349B	3008A02306	2015/05/19	2016/05/18
Amplifier	Agilent	8447D	2944A10176	2015/05/19	2016/05/18
Temperature/ Humidity Meter	Gangxing	CTH-608	02	2015/05/20	2016/05/19
High-Pass Filter	K&L	9SH10- 2700/X12750-O/O	N/A	2015/05/20	2016/05/19
High-Pass Filter	K&L	41H10- 1375/U12750-O/O	N/A	2015/05/20	2016/05/19
Coaxial Cables	HUBER+SUHNER	SUCOFLEX 104PEA-10M	10m	2015/06/02	2016/06/01
Coaxial Cables	HUBER+SUHNER	SUCOFLEX 104PEA-3M	3m	2015/06/02	2016/06/01
Coaxial Cables	HUBER+SUHNER	SUCOFLEX 104PEA-3M	3m	2015/06/02	2016/06/01
RF Cable	Megalon	RF-A303	N/A	2015/06/02	2016/06/01
Power Sensor	R&S	NRP-Z4	823.3618.03	2015.06.02	2016.06.01
Power Meter	R&S	NRVS	1020.1809.02	2015.06.02	2016.06.01

4 TEST CONDITIONS AND RESULTS

4.1 AC Power Conducted Emission

TEST CONFIGURATION



TEST PROCEDURE

- 1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system; a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10-2013.
- 2. Support equipment, if needed, was placed as per ANSI C63.10-2013
- 3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2013
- 4. The EUT received DC5V power from the adapter, the adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
- 5. All support equipments received AC power from a second LISN, if any.
- 6. The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
- 7. Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
- 8. During the above scans, the emissions were maximized by cable manipulation.

AC Power Conducted Emission Limit

For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following:

Eroquanav	Maximum RF Line Voltage (dBµV)						
(MU-)	CLA	SS A	CLASS B				
	Q.P.	Ave.	Q.P.	Ave.			
0.15 - 0.50	79	66	66-56*	56-46*			
0.50 - 5.00	73	60	56	46			
5.00 - 30.0	73	60	60	50			

* Decreasing linearly with the logarithm of the frequency

TEST RESULTS

The AC Power Conducted Emission measurement is performed at both TX and RX (Idle) mode, recorded worst case at TX mode..





MEASUREMENT RESULT:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.830000 0.918000 1.470000 2.078000 2.166000 4.382000	39.80 37.40 42.80 42.50 41.90 39.90	10.4 10.5 10.5 10.5 10.5 10.5	56 56 56 56 56	16.2 18.6 13.2 13.5 14.1 16.1	QP QP QP QP QP QP	L1 L1 L1 L1 L1 L1	GND GND GND GND GND GND

MEASUREMENT RESULT:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
1.370000 1.466000 1.558000 1.662000 2.078000 2.174000	34.90 35.90 35.90 34.90 34.90 34.70	10.5 10.5 10.5 10.5 10.5 10.5	46 46 46 46 46	11.1 10.1 10.1 11.1 11.1 11.3	AV AV AV AV AV AV	L1 L1 L1 L1 L1 L1	GND GND GND GND GND GND

L:



MEASUREMENT RESULT:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
1.682000	33.30	10.5	56	22.7	QP	Ν	GND
1.950000	31.30	10.5	56	24.7	QP	Ν	GND
2.170000	30.80	10.5	56	25.2	QP	Ν	GND
2.298000	30.40	10.5	56	25.6	QP	Ν	GND
2.386000	29.30	10.5	56	26.7	QP	Ν	GND
2.442000	30.80	10.5	56	25.2	QP	Ν	GND

MEASUREMENT RESULT:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.934000	21.30	10.5	46	24.7	AV	Ν	GND
1.382000	23.90	10.5	46	22.1	AV	Ν	GND
1.482000	24.60	10.5	46	21.4	AV	Ν	GND
1.578000	24.20	10.5	46	21.8	AV	Ν	GND
1.674000	23.80	10.5	46	22.2	AV	Ν	GND
2.406000	21.80	10.5	46	24.2	AV	Ν	GND

4.2 Radiated Emissions and Band Edge

TEST CONFIGURATION



TEST PROCEDURE

- 1. The EUT was placed on a turn table which is 0.8m above ground plane for below 1GHz and 1.50m above ground plane for above 1GHz.
- 2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0°C to 360°C to acquire the highest emissions from EUT.
- 3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 4. Repeat above procedures until all frequency measurements have been completed.
- 5. The EUT minimum operation frequency was 32.768 KHz and maximum operation frequency was 2480MHz.so radiated emission test frequency band from 9 KHz to 25GHz.
- 6. The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
9KHz-30MHz	Active Loop Antenna	3
30MHz-1GHz	Ultra-Broadband Antenna	3
1GHz-18GHz	Double Ridged Horn Antenna	3

18GHz-25	GHz Horn A	Anternna	1
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7. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector	
i ooti i ooti i ooti ooji omigo	· · · · · · · · · · · · · · · · · · ·		
9KHz-150KHz	RBW=200Hz/VBW=3KHz,Sweep time=Auto	QP	
150KHz-30MHz	RBW=9KHz/VBW=100KHz,Sweep time=Auto	QP	
30MHz-1GHz	QP		
	Peak Value: RBW=1MHz/VBW=3MHz,	Dook	
	Sweep time=Auto	Реак	
IGHZ-40GHZ	Average Value: RBW=1MHz/VBW=10Hz,	Peak	
	Sweep time=Auto		

More procudre as follows;

1) Sequence of testing 9 kHz to 30 MHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

- --- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.
- --- If the EUT is a floor standing device, it is placed on the ground.
- --- Auxiliary equipment and cables were positioned to simulate normal operation conditions.
- --- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- --- The measurement distance is 3 meter.
- --- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

- --- The antenna height is 1.0 meter.
- --- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

--- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QP detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

2) Sequence of testing 30 MHz to 1 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

- --- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- --- The measurement distance is 3 meter.
- --- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

- --- The antenna is polarized vertical and horizontal.
- --- The antenna height changes from 1 to 4 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

3) Sequence of testing 1 GHz to 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

- --- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- --- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- --- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- --- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- --- The measurement distance is 3 meter.
- --- The EUT was set into operation.

Premeasurement:

- --- The turntable rotates from 0° to 315° using 45° steps.
- --- The antenna is polarized vertical and horizontal.
- --- The antenna height scan range is 1 meter to 2.5 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

4) Sequence of testing above 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

- --- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- --- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- --- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- --- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- --- The measurement distance is 1 meter.
- --- The EUT was set into operation.

Premeasurement:

--- The antenna is moved spherical over the EUT in different polarizations of the antenna.

Final measurement:

--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

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	

For example

Frequency	FS	RA	AF	CL	AG	Transd
(MHz)	(dBµV/m)	(dBµV/m)	(dB)	(dB)	(dB)	(dB)
300.00	40	58.1	12.2	1.6	31.90	-18.1

Transd=AF +CL-AG

RADIATION LIMIT

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission out of authorized band shall not exceed the following table at a 3 meters measurement distance. 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)

The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos.

Frequency (MHz)	Distance (Meters)	Radiated (dBµV/m)	Radiated (µV/m)
0.009-0.49	300	20log(2400/F(KHz))+80	2400/F(KHz)
0.49-1.705	30	20log(24000/F(KHz))+40	24000/F(KHz)
1.705-30	30	20log(30)+40	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

TEST RESULTS

Remark:

1. The radiated measurement are performed the each channel (low/mid/high), the datum recorded below (the middle channel) is the worst case for all test channels.

2. ULTRA-BROADBAND ANTENNA for the radiation emission test below 1G.

3. HORN ANTENNA for the radiation emission test above 1G.

4. We tested both battery powered and powered by adapter charging mode at three orientations, recorded worst case at powered by adapter charging mode.

5. "---" means not recorded as emission levels lower than limit.

6. Margin= Limit - Level

For 9KHz to 30MHz

Frequency (MHz)	Corrected Reading (dBµV/m)@3m	FCC Limit (dBµV/m) @3m	Margin (dB)	Detector	Result
12.65	47.52	69.54	22.02	QP	PASS
20.14	45.36	69.54	24.18	QP	PASS



For 1GHz to 25GHz

	Frequency((MHz):		2402		Polarity:			HORIZONTAL		
No.	Frequency (MHz)	Emissi Leve (dBuV/	on l m)	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)	
1	2402.00	80.65	ΡK			47.25	28.78	4.61	0	33.4	
1	2402.00	72.55	AV			39.15	28.78	4.61	0	33.4	
2	2390.00	36.97	ΡK	74	37.03	3.65	28.72	4.6	0	33.32	
2	2390.00		AV	54							
3	2400.00	38.8	ΡK	74	35.2	5.41	28.78	4.61	0	33.39	
3	2400.00		AV	54							
4	4804.00	47.74	ΡK	74	26.26	43.23	33.49	6.91	35.89	4.51	
4	4804.00		AV	54							
5	5115.75	44.93	ΡK	74	29.07	37.74	34.36	7.1	34.27	7.19	
5	5115.75		AV	54							
6	7206.00	46.46	ΡK	74	27.54	35.35	36.95	9.18	35.03	11.11	
6	7206.00		AV	54							

	Frequency(MHz):		240	2	Polarity:			VERTICAL		
No.	Frequency (MHz)	Emissi Leve (dBuV/	on l m)	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)	
1	2402.00	80.26	ΡK			46.86	28.78	4.61	0	33.4	
1	2402.00	72.76	AV			39.36	28.78	4.61	0	33.4	
2	2390.00	36.87	ΡK	74	37.13	3.55	28.72	4.6	0	33.32	
2	2390.00		AV	54							
3	2400.00	39.13	ΡK	74	34.87	5.74	28.78	4.61	0	33.39	
3	2400.00		AV	54							
4	4804.00	48.37	ΡK	74	25.63	43.86	33.49	6.91	35.89	4.51	
4	4804.00		AV	54							
5	5325.50	45.88	ΡK	74	28.12	38.35	34.67	7.22	34.35	7.53	
5	5325.50		AV	54							
6	7206.00	46.85	ΡK	74	27.15	35.74	36.95	9.18	35.03	11.11	
6	7206.00		AV	54							

REMARKS:

1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)

 Emission level (dBuV/m) = Raw Value (dBuV)+Correction Factor (dB/m)
 Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
 Margin value = Limit value- Emission level.
 -- Mean the PK detector measured value is below average limit.
 The other emission levels were very low against the limit.
 RBW1MHz VBW3MHz Peak detector is for PK value; RBW 1MHz VBW10Hz Peak detector is for PK value; RBW 1MHz VBW10Hz Peak detector is for AV value.

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	Frequency(MHz):			244	0	Polarity:			HORIZONTAL		
No.	Frequency (MHz)	Emissi Leve (dBuV/	on I m)	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)	
1	2440.00	81.66	ΡK		-	48.15	28.85	4.65	0	33.51	
1	2440.00	73.56	AV	-	-	40.05	28.85	4.65	0	33.51	
2	4052.25	40.77	ΡK	74	33.23	36.16	32.96	6.43	34.77	4.61	
2	4052.25	-	AV	54	-	-					
3	4880.00	49	ΡK	74	25	42.75	33.6	6.95	34.3	6.25	
3	4880.00		AV	54							
4	5175.50	45.78	ΡK	74	28.22	38.29	34.49	7.13	34.13	7.49	
4	5175.50	-	AV	54	-	-					
5	7320.00	46.2	ΡK	74	27.8	34.51	37.46	9.23	35	11.69	
5	7320.00		AV	54							

	Frequency((MHz):		244	0	Polarity:			VERTICAL		
No.	Frequency (MHz)	Emissi Leve (dBuV/	on l m)	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)	
1	2440.00	81.76	ΡK			48.25	28.85	4.65	0	33.51	
1	2440.00	73.65	AV			40.14	28.85	4.65	0	33.51	
2	4330.50	40.36	ΡK	74	33.64	35.53	32.84	6.61	34.61	4.83	
2	4330.50	-	AV	54	-						
3	4880.00	47.72	ΡK	74	26.28	41.47	33.6	6.95	34.3	6.25	
3	4880.00	-	AV	54	-						
4	5175.50	45.85	ΡK	74	28.15	38.36	34.49	7.13	34.13	7.49	
4	5175.50	1	AV	54							
5	7320.00	45.55	ΡK	74	28.45	33.86	37.46	9.23	35	11.69	
5	7320.00		AV	54							

REMARKS:

- 1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
- 2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor

3. Margin value = Limit value- Emission level.

- 4. -- Mean the PK detector measured value is below average limit.5. The other emission levels were very low against the limit.

6. RBW1MHz VBW3MHz Peak detector is for PK value; RBW 1MHz VBW10Hz Peak detector is for AV value.

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	Frequency((MHz):		248	0	Polarity:			HORIZONTAL		
No.	Frequency (MHz)	Emissi Leve (dBuV/	on l m)	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)	
1	2480.00	80.37	ΡK			46.75	28.92	4.7	0	33.62	
1	2480.00	73.05	AV			39.43	28.92	4.7	0	33.62	
2	2483.50	39.04	ΡK	74	34.96	5.41	28.93	4.7	0	33.63	
2	2483.50		AV	54							
3	2500.00	36.53	ΡK	74	37.47	2.85	28.96	4.72	0	33.68	
3	2500.00		AV	54							
4	4960.00	48.78	ΡK	74	25.22	43.86	33.84	7	35.92	4.92	
4	4960.00		AV	54							
5	5025.50	43.67	ΡK	74	30.33	36.79	34.07	7.05	34.24	6.88	
5	5025.50		AV	54							
6	7440.00	41.84	PK	74	32.16	29.89	37.64	9.28	34.97	11.95	
6	7440.00		AV	54							

	Frequency(MHz):			248	0	Polarity:			VERTICAL		
No.	Frequency (MHz)	Emissi Leve (dBuV/	on l m)	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)	
1	2480.00	80.36	ΡK			46.74	28.92	4.7	0	33.62	
1	2480.00	72.38	AV			38.76	28.92	4.7	0	33.62	
2	2483.50	39.08	ΡK	74	34.92	5.45	28.93	4.7	0	33.63	
2	2483.50		AV	54							
3	2500.00	36.31	ΡK	74	37.69	2.63	28.96	4.72	0	33.68	
3	2500.00	1	AV	54	-	-		1			
4	4960.00	48.66	ΡK	74	25.34	43.74	33.84	7	35.92	4.92	
4	4960.00		AV	54							
5	5415.25	43.58	ΡK	74	30.42	35.95	34.74	7.27	34.38	7.63	
5	5415.25		AV	54							
6	7440.00	42.38	ΡK	74	31.62	30.43	37.64	9.28	34.97	11.95	
6	7440.00		AV	54							

REMARKS:

- 1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
- 2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
- Margin value = Limit value- Emission level.
 -- Mean the PK detector measured value is below average limit.
 The other emission levels were very low against the limit.
- 6. RBW1MHz VBW3MHz Peak detector is for PK value; RBW 1MHz VBW10Hz Peak detector is for AV value.

4.3 Maximum Peak Output Power

TEST CONFIGURATION



TEST PROCEDURE

According to KDB558074 D01 DTS Mea Guidance v03r02 9.1.2 PKPM1 Peak power meter method "The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector."

<u>LIMIT</u>

The Maximum Peak Output Power Measurement is 30dBm.

TEST RESULTS

A. Test Verdict

Channel	Frequency (MHz)	Measured Output Peak Power (dBm)	Limits (dBm)	Verdict
00	2402	-2.94	30	PASS
19	2440	-2.60	30	PASS
39	2480	-3.02	30	PASS

Note:

1. The test results including the cable lose.

4.4 Power Spectral Density

TEST CONFIGURATION



TEST PROCEDURE

According to KDB 558074 D01 V03 Method PKPSD (peak PSD) this procedure shall be used if maximum peak conducted output power was used to demonstrate compliance, and is optional if the maximum conducted (average) output power was used to demonstrate compliance.

- 1. Set analyzer center frequency to DTS channel center frequency.
- 2. Set the span to 1.5 times the DTS bandwidth.
- 3. Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- 4. Set the VBW \geq 3 RBW.
- 5. Detector = peak.
- 6. Sweep time = auto couple.
- 7. Trace mode = max hold.
- 8. Allow trace to fully stabilize.
- 9. Use the peak marker function to determine the maximum amplitude level within the RBW.

10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

<u>LIMIT</u>

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

TEST RESULTS

A. Test Verdict

Channel	Frequency (MHz)	Report PSD (dBm/100kHz)	Refer to Plot	Limits (dBm/3KHz)	Verdict
00	2402	-3.853	Plot 4.4.1 A	8	PASS
19	2440	-3.482	Plot 4.4.1 B	8	PASS
39	2480	-3.933	Plot 4.4.1 C	8	PASS

Note

1. The test results including the cable lose.

B. Test Plots

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Agilent Spe	ectrum Analyzer - Swept SA					
<mark>(X)</mark> Marke	RF 50 Ω AC r 1 2 / 0198///00750		AVA TVPE	ALIGN OFF 09:13:47 : Log-Pwr TR	AM Jan 20, 2016	Peak Search
menke	1 1 2.401304400730	PNO: Wide 🖵 Trig: Free	Run Avg Hold:	>100/100 T		
		IFGain:Low Atten: 30	dB			Next Peak
	Ref Offset 0.6 dB			MKr1 2.401 98	34 4 GHZ	Noxer our
10 dB/di	iv Ref 20.00 dBm			-0.0	555 UBIII	
10.0						Next Pk Right
0.00			1			
						Next Pk Left
-10.0						HOATT N LOIT
-20.0						
						Marker Delta
-30.0						
-40.0						Mkr⊸CE
-50.0						
-60.0						Mkr→RefLvl
-70.0						
						More
Center	2 4020000 GHz			Snan	1.040 MHz	1 of 2
#Res E	SW 100 kHz	#VBW 300 kHz		Sweep 1.000 ms	(1001 pts)	
MSG					anment Failure	
					gei unuro	





(Plot 4.4.1 B: Channel 19: 2440 MHz @ GFSK)

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Agilent Sp	oectrum Analyzer - Swept SA					
(<mark>XI</mark> Marke	RF 50 Ω AC	SEN	NSE:INT Ava Type	ALIGN OFF 09:14:58	AM Jan 20, 2016 RACE 1 2 3 4 5 6	Peak Search
meand	CI 1 2.473302320030	PNO: Wide 🕞 Trig: Free	e Run Avg Hold:	100/100		
		IFGain:Low Atten: 30	dB		ber	Next Peak
	Ref Offset 0.6 dB			Mkr1 2.479 9	82 3 GHZ	Nextreak
10 dB/c Log	div Ref 20.00 dBm				933 abm	
Ĩ						
10.0						Next Pk Right
0.00		1	1			
		rim				Nevt Pk Left
-10.0				" The second sec		NEXT FR Left
	and the second s			AND	more	
-20.0						
						Marker Delta
-30.0 —						
-40.0						Mkr.CE
						WIKI→CF
-50.0						
-60.0 —						Mkr→RefLvl
-70.0						
						More
	- 0 4000000 011-			0	4.040 8411-	1 of 2
Gente #Res I	BW 100 kHz	#VBW 300 kHz		Span Sween 1.000 mg	1.040 MHZ	
MSC		# TBW 500 KHZ			ignment Eailurg	
Mag					ignment Fallure	;

(Plot 4.4.1 C: Channel 39: 2480 MHz @ GFSK

4.5 Spurious RF Conducted Emission

TEST CONFIGURATION



TEST PROCEDURE

The Spurious RF conducted emissions compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10-2013 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW=100 kHz and VBW= 300 KHz to measure the peak field strength, and measure frequency range from 9 KHz to 26.5GHz.

<u>LIMIT</u>

1. Below -20dB of the highest emission level in operating band.

2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

TEST RESULTS

Remark: The measurement frequency range is from 9KHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandege measurement data.

TEST RESULTS

Remark: The measurement frequency range is from 9 KHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandege measurement data.

Frequency (MHz)	Frequency Range	Refer to Plot	Limit (dBc)	Verdict
	2.402 GHz	Plot 4.5.1 A1		PASS
2402	30MHz-3 GHz	Plot 4.5.1 A2	-20	PASS
	3GHz-25GHz	Plot 4.5.1 A3	-20	PASS
2440	2.440 GHz	Plot 4.5.1 B1		PASS
	30MHz-3 GHz	Plot 4.5.1 B2	-20	PASS
	3GHz-25GHz	Plot 4.5.1 B3	-20	PASS
	2.480 GHz	Plot 4.5.1 C1		PASS
2480	30MHz-3 GHz	Plot 4.5.1 C2	-20	PASS
	3GHz-25GHz	Plot 4.5.1 C3	-20	PASS
	Frequency (MHz) 2402 2440 2480	Frequency (MHz) Frequency Range 2.402 GHz 2.402 GHz 2402 30MHz-3 GHz 3GHz-25GHz 2.440 GHz 2440 30MHz-3 GHz 2440 30MHz-3 GHz 2440 30MHz-3 GHz 2480 30MHz-3 GHz 30MHz-3 GHz 30MHz-3 GHz	Frequency (MHz) Frequency Range Refer to Plot 2.402 GHz Plot 4.5.1 A1 2402 30MHz-3 GHz Plot 4.5.1 A2 3GHz-25GHz Plot 4.5.1 A3 2402 3GHz-25GHz Plot 4.5.1 B1 2400 30MHz-3 GHz Plot 4.5.1 B1 2400 30MHz-3 GHz Plot 4.5.1 B2 3GHz-25GHz Plot 4.5.1 B3 2480 GHz Plot 4.5.1 C1 2480 30MHz-3 GHz Plot 4.5.1 C2 3GHz-25GHz Plot 4.5.1 C3	Frequency (MHz) Frequency Range Refer to Plot Limit (dBc) 2402 GHz Plot 4.5.1 A1 30MHz-3 GHz Plot 4.5.1 A2 -20 3GHz-25GHz Plot 4.5.1 A3 -20 2402 3GHz-25GHz Plot 4.5.1 B1 2400 30MHz-3 GHz Plot 4.5.1 B1 2400 30MHz-3 GHz Plot 4.5.1 B2 -20 3GHz-25GHz Plot 4.5.1 B3 -20 -20 3GHz-25GHz Plot 4.5.1 C1 2480 GHz Plot 4.5.1 C1 2480 30MHz-3 GHz Plot 4.5.1 C2 -20 3GHz-25GHz Plot 4.5.1 C3 -20

Plot 4.5.1 D1

Plot 4.5.1 D2

-20

-20

PASS

PASS

A. Test Verdict

1. The test results including the cable lose.

2. For 9KHz -30MHz, Because there was only background, So We did not recorded data.

Left Band edge

Right Band edge

B. Test Plots

Conducted

bandedge

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Agilent Spec	trum Analyzer - Swept SA							
<mark>.x</mark> Marker	RF 50 Ω AC 1 2 401984400750) GHz	SENSE:INT	Avg Type:	Log-Pwr	09:13:47 AN TRAC	1 Jan 20, 2016	Peak Search
Marker		PNO: Wide Trig IFGain:Low Atte	j: Free Run en: 30 dB	Avg Hold:>	100/100	TYP DE	E M WWWWW T P N N N N N	Next Deck
10 dB/div Log	Ref Offset 0.6 dB Ref 20.00 dBm				Mkr1 2.	401 984 -3.8	4 GHz 53 dBm	NextPeak
10.0								Next Pk Right
0.00 -10.0								Next Pk Left
-20.0								Marker Delta
-40.0								Mkr→CF
-50.0								Mkr→RefLvl
-70.0 Center :	2.4020000 GHz					Span 1.	040 MHz	More 1 of 2
#Res B	W 100 kHz	#VBW 300	kHz	8	Sweep 1.	000 ms (1	1001 pts)	
MSG						🛛 RF Aligr	nment Failure	9

(Plot 4.5.1 A1: Channel 00: 2402MHz @ GFSK)



(Plot 4.5.1 A2: Channel 00: 2402MHz @ GFSK)

Agilent	Spectrum	Analyzer - Swep	ot SA			-					
<mark>.x</mark> Mar	ker 1	RF 50 9	Ω AC	GHz		NSE:INT	Avg Type	ALIGN OFF	09:27:14 Al	M Jan 20, 2016) E <mark>1 2 3 4 5 6</mark>	Peak Search
in teach				PNO: Fast 🖵	Trig: Free	e Run dB	Avg Hold:	2/100	TYI DI	e M wwwww T P N N N N N	
				Galu:LOW	Atten: 00			M	kr1 23 1	30 CH7	Next Peak
10 de	Ridio	Ref Offset 0	.6 dB dBm					141	-48.6	46 dBm	
Log	57019	1101 20.00									
											Nevt Pk Pight
10.0											NEXT FK KIGHT
0.00											
10.0											Next Pk Left
-10.0											
-20.0											
										-23.85 dBm	Marker Delta
-30.0											
-40.0											Mkr→CF
										↓ ¹	
-50.0									and we have	WHY HALL	
		. Anthia				June March	why of the states and	Winner	low of a data		
-60.0	AN AND	Aller Contractions	A Grand Contraction	high white a state	, l-ulutodylayidi						Mkr→RefLvi
-70.0											Moro
											1 of 2
Star	t 3.00	GHz							Stop 2	5.00 GĤz	1012
#Re	s BW 1	00 kHz		#VBW	300 kHz			Sweep	2.103 s (1001 pts)	
MSG									🗙 RF Alig	nment Failur	e

(Plot 4.5.1 A3: Channel 00: 2402MHz @ GFSK)

Agilent Spectru	ım Analyzer - Swept SA							
Worker 1	RF 50Ω AC		ENSE:INT		ALIGN OFF	09:14:24 AM	4 Jan 20, 2016	Peak Search
marker 1	2.439961260900	PNO: Wide 😱 Trig: Fr	ee Run	Avg Hold:	>100/100	TYF		
		IFGain:Low Atten:	30 dB			DE	T PINN N N N	NextBrack
	Ref Offset 0.6 dB				Mkr1 2	439 98	1 3 GHz	NextPeak
10 dB/div	Ref 20.00 dBm					-3.4	82 dBm	
								Next Pk Right
10.0								Next 1 K Right
0.00			}					
	and the second s	www		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~				Next Pk Left
-10.0								
						سورر	~	
-20.0								
								Marker Delta
-30.0								
-40 N								
1010								Mkr→CF
50.0								
-30.0								
								Mkr. Doft vi
-60.0								
-70.0								
								More
Center 2	4400000 GHz					Span 1	.040 MHz	1 of 2
#Res BW	100 kHz	#VBW 300 kH	z		Sweep 1	.000 ms (1001 pts)	
MSG						🕄 RF Alia	nment Failur	e
					0	• · · · · · · · · · · · · · · · · · · ·	and and	-

(Plot 4.5.1 B1: Channel 19: 2440MHz @ GFSK)

Agilent Spe	ectrum Analyzer - Swept SA					
<mark>w</mark> Marke	r 1 2.68815000000) GHz		ALIGN OFF e: Log-Pwr 1: 25/100	09:24:40 AM Jan 20, 2016 TRACE 1 2 3 4 5 6 TYPE MIAIANANAN	Peak Search
10 dB/di	Ref Offset 0.6 dB iv Ref 20.00 dBm	IFGain:Low Atten: 30	dB	Mkr	DET PNNNNN 2.688 2 GHz -56.045 dBm	Next Peak
10.0						Next Pk Right
0.00						Next Pk Left
-20.0					-23.48 dBm	Marker Delta
-40.0					1	Mkr→CF
-60.0 -60.0	pqutylludiydyytyitiitadigyyraystaat	WIII	den an han han an han a bhairt an han an han an han an hann an	shaan an	denter and the second	Mkr→RefLvl
Start 3 #Res B	BO MHZ BW 100 kHz	#VBW 300 kHz		Sweep 283	Stop 3.000 GHz 9.9 ms (1001 pts)	More 1 of 2
MSG				Kostatus 🔇	RF Alignment Failur	e

(Plot 4.5.1 B2: Channel 19: 2440MHz @ GFSK)



(Plot 4.5.1 B3: Channel 19: 2440MHz @ GFSK)

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Agilent Spectru	ım Analyzer - Swept SA				-		
Marker 1	RF 50 Ω AC	GH7	NSE:INT Avg	ALIGN OFF	09:14:58 AN TRAC	1 Jan 20, 2016 E <mark>1 2 3 4 5 6</mark>	Peak Search
		PNO: Wide Trig: Fre IFGain:Low Atten: 30	eRun Avg∥⊢)dB	Hold:>100/100	TYP DE	E M WWWW T P N N N N N	
10 dB/div	Ref Offset 0.6 dB Ref 20.00 dBm			Mkr1 2	.479 982 -3.93	2 3 GHz 33 dBm	Next Peak
10.0							Next Pk Right
0.00		R	1		m		Next Pk Left
-20.0						Mar and a second	Marker Delta
-40.0							Mkr→CF
-60.0							Mkr→RefLvl
-70.0 Center 2.4	48000000 GHz				Span 1	040 MHz	More 1 of 2
#Res BW	100 KHZ	#VBW 300 kHz		Sweep 1	.000 ms (ment Failur	
				NO STATUS		intent i allute	,

(Plot 4.5.1 C1: Channel 39: 2480MHz @ GFSK)



(Plot 4.5.1 C2: Channel 39: 2480MHz @ GFSK)

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Agilent	Spectrum	Analyzer - Swept	t SA		054	ICE JUIT		ALICH OFF	00:07:00 0	M Jan 20, 2016	
Marl	ker 1	23.086000	000000	GHz			Avg Type	: Log-Pwr	109:27:36 AI	×1 an 20, 2016 E 1 2 3 4 5 6	Peak Search
			Р IF	NO: Fast 🛛 🖵 Gain:Low	Trig: Free Atten: 30	e Run dB	Avg Hold:	1/100	DI		
10 dE	3/div	Ref Offset 0.0 Ref 20.00 (6 dB dBm					М	kr1 23.0 -48.9	86 GHz 07 dBm	Next Peak
Log											
10.0											Next Pk Right
0.00											
-10.0											ΝΕΧΊ ΡΚ ΔΕΠ
-20.0										-23.93 dBm	Marker Delta
-30.0											
-40.0										↓ ¹	Mkr→CF
-50.0								للإسلام ويتطور	and a state of the	hon when a start	
-60.0	^ψ νγ ^α η ^μ ιγψ	himlener	all	and a start to the	him and and	planter and	dagerin bilita and	AND ANY ANY LA			Mkr→RefLvl
-70.0											More
O (011-			^				Otom 0	5.00.011-	1 of 2
star #Res	s BW 1	onz 00 kHz		#VBW	300 kHz			Sweep	2.103 s (1001 pts)	
MSG									🔀 RF Alig	nment Failur	e

(Plot 4.5.1 C3: Channel 39: 2480MHz @ GFSK)



(Plot 4.5.1 D1: Left Band edge @ GFSK)

Agilent Spectrum Analyzer - Swept SA	A						
LXI RF 50 Ω	AC OLL	SENSE:INT	ALIGN OFF	09:21:45 AM Jan 20, 2016	Peak Search		
Marker 1 2.480222000	PNO: East	rig: Free Run Avg	Hold:>100/100				
	IFGain:Low	Atten: 30 dB		DET PNNNN			
			Mkr1 :	2.480 222 GHz	NextPeak		
Ref Offset 0.6 d	dB Rm			-3.771 dBm			
Log							
10.0							
					Next Pk Right		
100 M							
-10.0							
-20.0							
-30.0					Next Pk Left		
-40.0							
-50.0	$\langle \rangle^2$						
-60.0	1mm www. and providence and	and the second and the second and a second and a second and the se		al more and a part of the second	Marker Delta		
-70.0							
Start 2.47800 GHz				Stop 2.50000 GHz			
#Res BW 100 kHz	#VBW 3	DO KHZ	Sweep 2.1	133 ms (1001 pts)	MKr→CF		
MKR MODE TRC SCL	X	Y FUNCTION	FUNCTION WIDTH	FUNCTION VALUE			
	2.480 222 GHz -	3.771 dBm					
	2.483 500 GHZ -5	9.//UdBm			Mire Defini		
4					wiki → Rei Lvi		
5							
7							
8					More		
10					1 of 2		
11				_			
мsg 🔱 File <2480_0001.png	ISG I File <2480_0001.png> saved						

(Plot 4.5.1 D2: Right Band edge @ GFSK)

4.6 6dB Bandwidth

TEST CONFIGURATION



TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW=100 KHz and VBW=300KHz. The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB. According to KDB558074 D01 V03 for one of the following procedures may be used to determine the modulated DTS device signal bandwidth.

- 1. Set RBW = 100 kHz.
- 2. Set the video bandwidth (VBW) \ge 3 RBW.
- 3. Detector = Peak.
- 4. Trace mode = max hold.
- 5. Sweep = auto couple.
- 6. Allow the trace to stabilize.

7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

LIMIT

For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

TEST RESULTS

A. Test Verdict

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Refer to Plot	Limits (kHz)	Verdict
00	2402	0.6933	Plot 4.6.1 A	≥500	PASS
19	2440	0.6959	Plot 4.6.1 B	≥500	PASS
39	2480	0.6940	Plot 4.6.1 C	≥500	PASS

Note:

1. The test results including the cable lose.

B. Test Plots

Agilent Spectrum Analyzer - Occupied BW					
LXI RF 50 Ω AC		SENSE:INT	ALIGN OFF	09:11:17 AM Jan 20, 2016	Frequency
Center Freq 2.40200000	0 GHz Cente	r Freq: 2.402000000 GH: Free Pun AvalHa	z R ∾I√~10/10	adio Std: None	requeries
	#IFGain:Low #Atten	: 30 dB	R	adio Device: BTS	
10 dB/div Ref 20.00 dB	m				
10.0					Contor From
					CenterFreq
0.00					2.402000000 GHz
-10.0					
-20.0					
-30.0					
49.0			harmon		
-40.0					
-50.0				the former of	
-60.0					
-70.0					
Center 2.402 GHz				Span 3 MHz	CF Step
#Res BW 100 kHz	#	VBW 300 kHz		Sweep 1 ms	300.000 kHz
					Auto Man
Occupied Bandwid	th	Total Power	3.34 d	Bm	
1	0283 MHz				Ener Offerst
					FreqOffset
Transmit Freg Error	-10.598 kHz	OBW Power	99.0	0 %	0 Hz
			c		
X dB Bandwidth	693.3 KHZ	хав	-6.00	ав	
100			The area and	DE Alianment E. II	
MSG				RF Alignment Failur	e





(Plot 4.6.1 B: Channel 19: 2440MHz @ GFSK)

Agilent Spectrum Analyzer - Occupied BW							
ιχι RF 50 Ω AC		SENSE:INT	\Lambda ALIGN OFF	09:09:12 AM Jan	20, 2016	Trace/Detector	
Ref Value 20.00 dBm	Cente	r Freq: 2.480000000 GH	iz F	ladio Std: Noi	ne	TracerDetector	
	HECoindon #Atten	reekun Avg∣⊓ ∵30 AB	101a:>10/10	adio Device:	BTS		
	#IFGalfi:Low #Accen		1.	taulo Device.			
10 dB/div Ref 20.00 dBr	n						
Log							
10.0							
0.00						Clear Write	
-10.0							
-20.0							
-30.0						Average	
				~		Ŭ	
-40.0							
-50.0							
-60.0				~	Mann		
70.0						ινίαχ ποια	
-70.0							
Contor 2.49 CHz				- Cnon	2 844-		
THE Z.48 GHZ	#			Sparr			
#Res BW TOURHZ	#			Sweep		Min Hold	
		Total Dowar	2.22 -	I Dama			
Cccupied Bandwidt	in	rotal Power	3.22 0	ырпп			
1	0315 MHz					Detector	
						Average►	
Transmit Freg Error	-12.875 kHz	OBW Power	99.0	0 %	A	<u>uto</u> Man	
				,,,			
x dB Bandwidth	694.0 kHz	x dB	-6.00)dB			
MSG	MSG STATUS 🔀 RF Alianment Failure						
				-			

(Plot 4.6.1 C: Channel 39: 2480MHz @ GFSK)

4.7 Antenna Requirement

Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to FCC 47 CFR Section 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 6dBi.

Refer to statement below for compliance

The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

Measurement

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module.

Conducted power refer ANSI C63.10 :2013 Output power test procedure for DTS devices Radiated power refer to ANSI C63.10 :2013 Radiated emissions tests.

Measurement parameters

Measurement parameter				
Detector:	Peak			
Sweep time:	Auto			
Resolution bandwidth:	1MHz			
Video bandwidth:	3MHz			
Trace-Mode:	Max hold			

Limits

FCC	IC				
Antenna Gain					
6 dBi					

Results

T _{nom}	V _{nom}	Lowest Channel 2402 MHz	Middle Channel 2440 MHz	Highest Channel 2480 MHz	
Conducted p Measured with G	oower [dBm] GFSK modulation	-2.95	-2.61	-3.02	
Radiated power [dBm] Measured with GFSK modulation		-2.12	-1.66	-2.21	
Gain [dBi] Calculated		0.86	0.95	0.81	
Measuremer	nt uncertainty	± 0.6 dB (cond.) / ± 2.56 dB (rad.)			

5 <u>Test Setup Photos of the EUT</u>

Please refer to separated files for Test Setup Photos of the EUT.

6 External Photos of the EUT

Please refer to separated files for External Photos of the EUT.

7 Internal Photos of the EUT

Please refer to separated files for Internal Photos of the EUT.

.....End of Report.....