FCC RF
TEST REPORT

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Test Report Number: SKT-RFC-150007
Date of issue: June 5, 2015

Applicant:	**Infopia Co., Ltd.** 132, Anyangcheondong-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Korea
Manufacturer:	**Infopia Co., Ltd.** 132, Anyangcheondong-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Korea
Product:	Digital Blood Pressure Monitor
Model:	**SE-9400BLE** (please see P5 for all the model numbers)
FCC ID:	WSX-SE-9400BLE
File number:	SKTEU15-0300
EUT received:	April 3, 2015
Applied standards:	ANSI C63.10-2009 and ANSI C63.4-2009 558074 D01 DTS Meas Guidance v03r02
Rule parts:	FCC Part 15 Subpart C - Intentional radiators
Equipment Class:	**DTS - Part 15 Digital Transmission System**
Remarks to the standards:	None

The above equipment has been tested by SK Tech Co., Ltd., and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product or system, which was tested.

Inyong Song **/ Testing Engineer**

Jongsoo Yoon **/ Technical Manager**

Revision History of Report

Rev.	Revisions	Effect page	Reviewed by	Date
-	Initial issue	All	Jongsoo Yoon	June 5, 2015

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1 Summary of test results

Requirement	CFR 47 Section	Result
Antenna Requirement	15.203, 15.247(b)(4)	Meets the requirements
6dB Bandwidth	15.247(a)(2)	Meets the requirements
Maximum Peak Output Power	15.247(b)(3), (4)	Meets the requirements
Spurious Emission, Band Edge, and Restricted bands	15.247(d), 15.205(a), 15.209(a)	Meets the requirements
Peak Power Spectral Density	15.247(e)	Meets the requirements
AC power line Conducted emissions	15.207(a)	Meets the requirements

2 Description of equipment under test (EUT)

Product:	Digital Blood Pressure Monitor
Model:	**SE-9400BLE**
Serial number:	None (prototype)

Model differences:

Model name	Difference	Tested (checked)
SE-9400BLE	Fully tested model that was provided by the applicant	☒

Technical data:

Power source	DC 6 V (AA alkaline 1.5 V x 4) or (AC Adapter)
Local Oscillator or X-Tal	32.768 kHz, 32 MHz
Transmit Frequency	2402 MHz ~ 2480 MHz (40 channels, Bluetooth LE only)
Antenna Type	Integral PCB antenna(gain: 0 dBi)
Type of Modulation	GFSK
RF Output power	-2.36 dBm PEAK(measured)

Note: *1) The test report for the compliance with FCC Part 15B as a digital device was issued with other test report number*

I/O port	Type	Q'ty	Remark
DC Input	Jack	1	

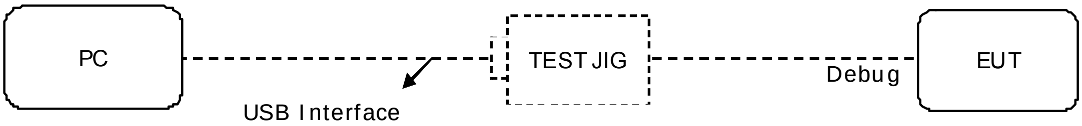
Modification of EUT during the compliance testing: none
The EUT was modified in order to meet the technical requirements. The details of the modifications were described at the end of this report.

Test suites	EMC measures
Radiated disturbance	(a) EMI suppression paint was applied inside of the enclosure (b) The gaskets were added on the ground of the mainboard and on the PUMP, and they were contacted to the enclosure

3 Test and measurement conditions

3.1. Test configuration (arrangement of EUT)

The measurements were taken in continuous transmitting mode without off-time intervals. For controlling the EUT as TEST MODE, the test program and the cable assembly were provided by the applicant.



The measurements were taken in TEST MODE provided by the applicant for controlling the EUT.

■ Software version (Smart RF Studio 7): 1.16.1
■ Software manufacturer:Texas Instruments.
■ Power setting: 0 dBm

3.2. Description of support units (accessory equipment)

The following support units or accessories were used to form a representative test configuration during the tests.

#	Equipment	Manufacturer	Model No.	Serial No.
1	PC	DELL INC.	7XH86BX	17261795085
2	TEST JIG	-	-	-

Note: *For radiated spurious emission measurements, the measurements were performed without PC after setting the radio module to TEST MODE.*

3.3. Interconnection and I/O cables

The following support units or accessories were used to form a representative test configuration during the tests.

#	Start		End		Cable	
	Name	I/O port	Name	I/O port	length (m)	shielded (Y/N)
1	EUT	Debug	TEST JIG	-	0.1	N
2	TEST JIG	USB	PC	USB	1.0	N

Note: *1) All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.*

3.4. Measurement Uncertainty (*U*)

Measurement Item	Combined Standard Uncertainty *Uc*	Expanded Uncertainty $U = k \times Uc$ (k = 2)
Conducted RF power	±1.49 dB	±2.98 dB
Radiated disturbance	±2.30 dB	±4.60 dB
Conducted disturbance	±1.96 dB	±3.92 dB

3.5. Test date

Date Tested	May 12, 2015 – May 18, 2015

4 Facilities and accreditations

4.1. Facilities

All of the measurements described in this report were performed at SK Tech Co., Ltd
Site I: 820-2, Wolmoon-ri, Wabu-up, Namyangju-si, Kyunggi-do, Korea
Site II: 688-8, Wolmoon-ri, Wabu-up, Namyangju-si, Kyunggi-do, Korea

The sites are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-4. The sites comply with the Normalized Site Attenuation requirements given in ANSI C63.4, and site VSWR requirements specified in CISPR 16-1-4. The measuring apparatus and ancillary equipment conform to CISPR 16-1 series.

4.2. Accreditations

The laboratory has been also notified to FCC by RRA as a Conformity Assessment Body, and designated to perform compliance testing on equipment subject to Declaration of Conformity (DOC) and Certification under Parts 15 and 18 of the FCC Rules.

Designation No.	KR0007

4.3. List of test and measurement instruments

No	Description	Manufacturer	Model	Serial No.	Cal. due	Use
1	Spectrum Analyzer	Agilent	E4405B	US40520856	2016.05.18	
2	Spectrum Analyzer	Agilent	E4440A	MY46186322	2016.03.05	☒
3	EMC Spectrum Analyzer	Agilent	E7405A	US40240203	2015.07.07	
4	EMI Test Receiver	Rohde&Schwarz	ESPI7	101206	2015.07.07	☒
5	EMI Test Receiver	Rohde&Schwarz	ESHS10	835871/002	2015.07.07	
6	Artificial Mains Network	Rohde&Schwarz	ESH2-Z5	834549/011	2015.07.09	
7	Pre-amplifier	HP	8447F	3113A05153	2015.07.07	☒
8	Pre-amplifier	MITEQ	AFS44	1116321	2015.07.09	
9	Pre-amplifier	MITEQ	AFS44	1116322	2016.03.04	☒
10	Power Meter	Agilent	E4417A	MY45100426	2015.07.08	
11	Power Meter	Agilent	E4418B	US39402176	2015.07.08	
12	Power Sensor	Agilent	E9327A	MY44420696	2015.07.08	
13	Power Sensor	Agilent	8485A	3318A13916	2015.07.08	
14	Attenuator (10dB)	HP	8491B	38072	2015.07.08	☒
15	High Pass Filter	Wainwright	WHKX3.0/18G	8	2015.07.08	☒
16	VHF Precision Dipole Antenna (TX/RX)	Schwarzbeck	VHAP	1014 / 1015	2015.09.18	
17	UHF Precision Dipole Antenna (TX/RX)	Schwarzbeck	UHAP	989 / 990	2015.09.18	
18	Loop Antenna	Schwarzbeck	HFH2-Z2	863048/019	2015.12.04	☒
19	TRILOG Broadband Antenna	Schwarzbeck	VULB9168	189	2016.05.23	☒
20	Horn Antenna	AH Systems	SAS-200/571	304	N/A	
21	Horn Antenna	EMCO	3115	00040723	2016.05.12	☒
22	Horn Antenna	EMCO	3115	00056768	2016.01.27	
23	Horn Antenna	Schwarzbeck	BBHA9170	BBHA9170318	2016.09.06	☒
24	Vector Signal Generator	Agilent	E4438C	MY42080359	2015.07.08	
25	PSG analog signal generator	Agilent	E8257D-520	MY45141255	2015.07.08	
26	DC Power Supply	HP	6622A	3348A03223	2015.07.07	☒
27	DC Power Supply	TOYOTECH	DP30-05A	-	N/A	
28	Hygro/Thermo Graph	Testo	608-H1	-	2015.07.25	☒
29	Temperature/Humidity Chamber	All Three	ATM-50M	20030425	2016.03.05	

5 Test and measurements

5.1. Antenna requirement

5.1.1 Regulation

According to §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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.
And according to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.1.2 Result: PASS

The transmitter has the integral PCB antenna. The directional gain of the antenna is less than 0 dBi.

5.2. 6 dB bandwidth

5.2.1 Regulation

According to §15.247(a)(2), systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.

5.2.2 Test Procedure

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 x 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.

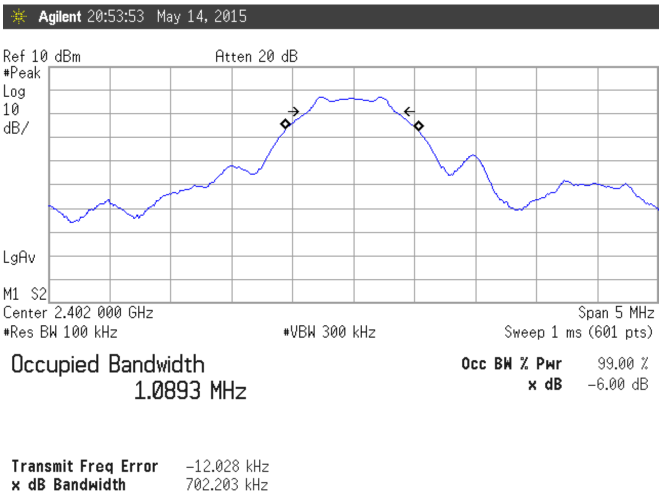
5.2.3 Test Results: PASS

Table 1: Measured value of the 6 dB Bandwidth

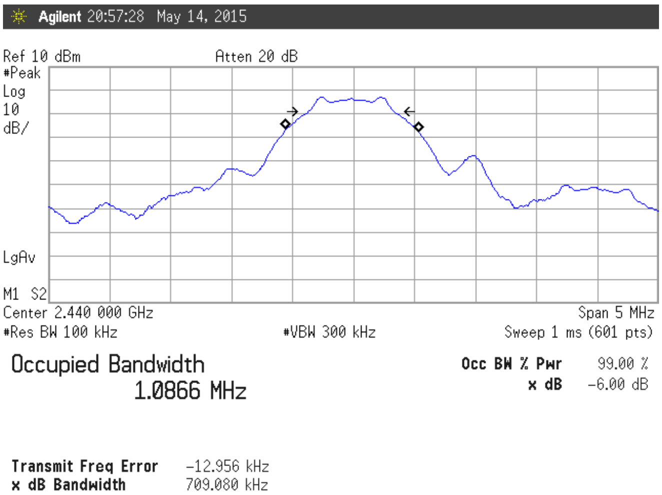
Modulation	Operating frequency	Occupied Bandwidth (99%)	6dB Bandwidth	Limit
GFSK	2402 MHz	1.089 MHz	0.702 MHz	≥ 500 kHz
	2440 MHz	1.087 MHz	0.709 MHz	≥ 500 kHz
	2480 MHz	1.094 MHz	0.698 MHz	≥ 500 kHz

Figure 1. Plot of the 6dB Bandwidth & Occupied Bandwidth (99%)

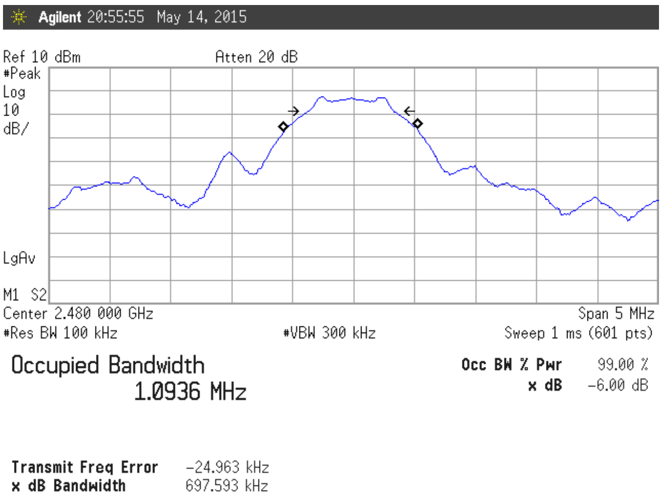
Lowest Channel (2402 MHz)



Middle Channel (2440 MHz)



Highest Channel (2480 MHz)



5.3. Maximum peak output power

5.3.1 Regulation

According to §15.247(b)(3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

According to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.3.2 Test Procedure

1. Set the RBW ≥ DTS bandwidth.
2. Set the VBW ≥ 3 x RBW
3. Set the span ≥ 3 x RBW.
4. Sweep time = auto couple.
5. Detector = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use peak marker function to determine the peak amplitude level.

5.3.3 Test Results: PASS

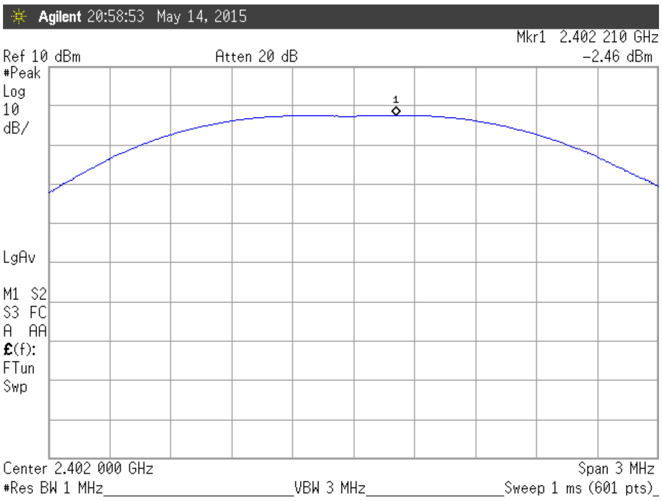
Table 2: Measured values of the Maximum Peak Conducted Output Power

Modulation	Operating Frequency	Peak Power		Average Power [dBm] (NOTE)	Limit
		[dBm]	W		
GFSK	2402 MHz	-2.46	0.000 567	-3.81	1 W
	2440 MHz	-2.76	0.000 530	-4.10	1 W
	2480 MHz	-2.36	0.000 581	-3.69	1 W

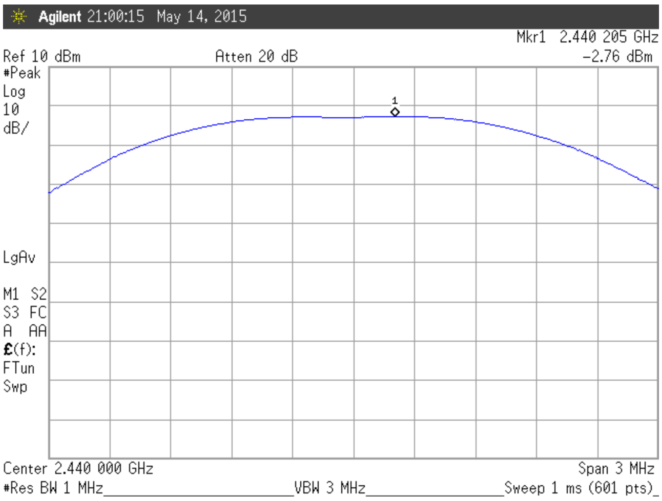
NOTE *The Average power were measured using AVGSA- 1 method as the reference only.*

Figure 2. Plot of the Maximum Peak Conducted Output Power

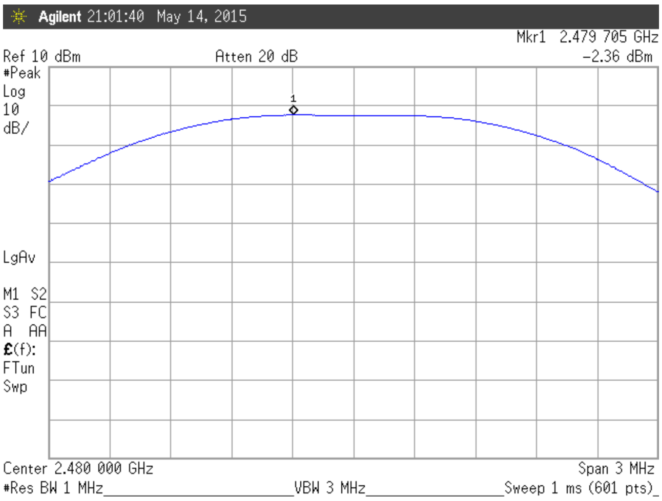
Lowest Channel (2402 MHz)



Middle Channel (2440 MHz)



Highest Channel (2480 MHz)



5.4. Spurious emissions, Band edge, and Restricted bands

5.4.1 Regulation

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).
According to §15.209(a), for an intentional device, the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency (MHz)	Field strength (μV/m @ 3m)	Field strength (dBμV/m @ 3m)
30–88	100	40.0
88–216	150	43.5
216–960	200	46.0
Above 960	500	54.0

According to §15.109(a), for an unintentional device, except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the above table.

** The emission limits shown in the above table are based on measurement instrumentation employing a CISPR quasi-peak detector and above 1000 MHz are based on the average value of measured emissions.

5.4.2 Test Procedure

<u>1) Band-edge measurements for RF conducted emissions</u>

1. Set the spectrum analyzer as follows:
   - Span = wide enough to capture the peak level of the emission operating on the channel closest to the band-edge, as well as any modulation products which fall outside of the authorized band of operation
   - RBW ≥ 1 % of spectrum analyzer display span
   - VBW ≥ 3 x RBW
   - Sweep = auto
   - Detector function = peak
   - Trace = max hold
2. Allow the trace to stabilize. Set the marker on the emission at the band-edge, or on the highest modulation product outside of the band, if this level is greater than that at the band-edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission.
3. Now, using the same instrument settings, enable the hopping function of the EUT. Allow the trace to stabilize. Follow the same procedure listed above to determine if any spurious emissions caused by the hopping function also comply with the specified limit.

2) Spurious RF Conducted Emissions:

1. Set the spectrum analyzer as follows:

    Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
    RBW = 100 kHz
    VBW ≥ 3 x RBW
    Sweep = auto
    Detector function = peak
    Trace = max hold

2. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.

3) Spurious Radiated Emissions:

1. The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions in an anechoic chamber at a distance of 3 meters for above 30 MHz, and at 1 meter / 3 meter distance for below 30 MHz.
2. The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360˚.
3. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 9 kHz to 30 MHz using the loop antenna, from 30 to 1000 MHz using the Trilog broadband antenna, and from 1 GHz to tenth harmonic of the highest fundamental frequency using the horn antenna.
4. To obtain the final measurement data, the EUT was arranged on a turntable situated on a 4 × 4 meter at the Open Area Test Site. The EUT was tested at a distance 3 meters.
5. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.
6. The EUT is situated in three orthogonal planes (if appropriate)
7. The presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT.
8. If the emission on which a radiated measurement must be made is located at the edge of the authorized band of operation, then the alternative “marker-delta” method may be employed.

4) Marker-Delta Method at the edge of the authorized band of operation:(ANSI c63.10, Subclause 6.9.3)

1. Perform an in-band field strength measurement of the fundamental emission using the RBW and detector function specified in 6.3 and 6.4, 6.5, or 6.6, as applicable, and the appropriate regulatory requirements for the frequency being measured.
2. Choose a spectrum analyzer span that encompasses both the peak of the fundamental emission and the band-edge emission under investigation. Set the analyzer RBW to approximately 1 % to 5 % of the total span, unless otherwise specified, with a video bandwidth equal to or greater than the RBW.
   Record the peak levels of the fundamental emission and the relevant band-edge emission (i.e., run several sweeps in peak hold mode). Observe the stored trace and measure the amplitude delta between the peak of the fundamental and the peak of the band-edge emission. This is not an absolute field strength measurement; it is only a relative measurement to determine the amount by which the emission drops at the band edge relative to the highest fundamental emission level.
3. Subtract the delta measured in b) from the field strengths measured in a). The resultant field strengths (CISPR QP, average, or peak, as appropriate) are then used to determine band-edge compliance of the restricted bands, described in 5.9.
4. The above “delta” measurement technique may be used for measuring emissions that are up to two “standard” bandwidths away from the band edge, where a “standard” bandwidth is the bandwidth specified by 4.2.3.2 for the frequency being measured. For example, band-edge measurements in the restricted band that begins at 2483.5 MHz require a measurement bandwidth of at least 1 MHz.
   Therefore the “delta” technique for measuring emissions up to 2 MHz removed from the band edge may be used. Radiated emissions that are removed by more than two “standard” bandwidths shall be measured in the conventional manner.

5.4.3 Test Results: PASS

Band-edge compliance of RF conducted/radiated emissions was shown in the Figure 3 and 4.
Spurious RF conducted emissions were shown in the Figure 5.

NOTE : for conducted measurement, we took the insertion loss of the cable loss into consideration within the measuring instrument. And for radiated measurement, the results were calibrated to the field strength within the measuring instrument; Table 3 contains the correction factors at the operating frequencies such as antenna factor, cable loss, etc.

Table 3: Measured values of the Field strength of spurious emission (Radiated)

BELOW 1 GHz

Frequency	Receiver Bandwidth	Pol.	Antenna Height	Turn Table	Reading	Amp Gain	ATT	AF	CL	Actual	Limit	Margin
[MHz]	[kHz]	[V/H]	[m]	[degree]	[dB(μV)]	[dB]	[dB]	dB(1/m)	[dB]	[dB(μV/m)]	[dB(μV/m)]	[dB]
Average/Peak/Quasi-peak data, emissions below 30 MHz												
No Radiated Spurious Emissions Found												
Quasi-peak data, emissions below 1000 MHz												
276.38	120	H	1.13	122	42.9	27.8	-	12.7	1.7	29.5	46.0	16.5
563.50	120	H	1.33	268	36.8	29.2	-	19.1	2.5	29.2	46.0	16.8
684.03	120	H	1.09	270	35.8	29.1	-	20.8	2.8	30.3	46.0	15.7

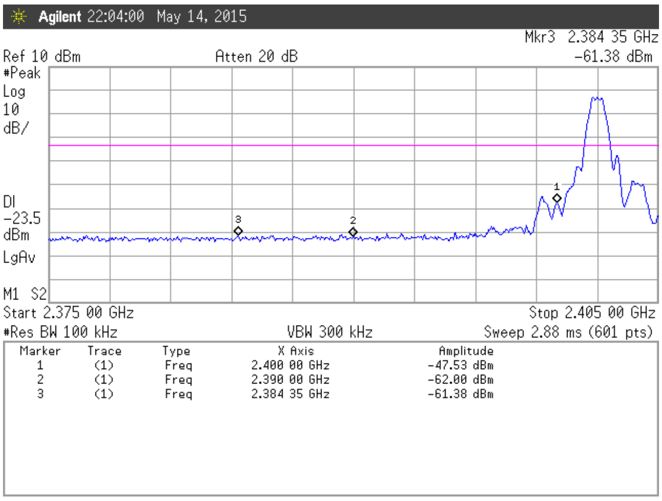
Margin (dB) = Limit – Actual
[Actual = Reading – Amp Gain + Attenuator + AF + CL]
1. H = Horizontal, V = Vertical Polarization
2. ATT = Attenuation (10dB pad and/or Insertion Loss of HPF), AF/CL = Antenna Factor and Cable Loss
NOTE: All emissions not reported were more than 20 dB below the specified limit or in the noise floor.

Measured values of the Field strength of spurious emission (Radiated) *(continued)*												
ABOVE 1 GHz												
Frequency	Receiver Bandwidth	Pol.	Antenna Height	Turn Table	Reading	Amp Gain	ATT	AF	CL	Actual	Limit	Margin
[MHz]	[kHz]	[V/H]	[m]	[degree]	[dB(μV)]	[dB]	[dB]	dB(1/m)	[dB]	[dB(μV/m)]	[dB(μV/m)]	[dB]
PEAK data, emissions above 1000 MHz												
2402.0	1000	H	1.17	44	78.91	48.59	10.43	28.24	4.62	73.61	Not Applicable	
2402.0	1000	V	1.00	296	77.54	48.59	10.43	28.24	4.62	72.24		
2319.2	1000	H	1.17	44	55.26	48.55	10.43	28.08	4.48	49.70	74.00	24.30
2319.6	1000	V	1.00	296	56.63	48.55	10.43	28.08	4.48	51.07	74.00	22.93
2440.0	1000	H	1.19	32	81.28	48.62	10.43	28.31	4.66	76.06	Not Applicable	
2440.0	1000	V	1.00	297	76.33	48.62	10.43	28.31	4.66	71.11		
2480.0	1000	H	1.16	37	80.39	48.64	10.44	28.38	4.71	75.28	Not Applicable	
2480.0	1000	V	1.00	295	77.28	48.64	10.44	28.38	4.71	72.17		
2491.6	1000	H	1.16	37	54.10	48.65	10.44	28.40	4.72	49.01	74.00	24.99
2502.4	1000	V	1.00	295	54.06	48.65	10.44	28.43	4.73	49.01	74.00	24.99
AVERAGE data, emissions above 1000 MHz												
2402.0	1000	H	1.17	44	77.62	48.59	10.43	28.24	4.62	72.32	Not Applicable	
2402.0	1000	V	1.00	296	76.14	48.59	10.43	28.24	4.62	70.84		
2319.2	1000	H	1.17	44	40.95	48.55	10.43	28.08	4.48	35.39	54.00	18.61
2319.6	1000	V	1.00	296	40.83	48.55	10.43	28.08	4.48	35.27	54.00	18.73
2440.0	1000	H	1.19	32	79.98	48.62	10.43	28.31	4.66	74.76	Not Applicable	
2440.0	1000	V	1.00	297	74.73	48.62	10.43	28.31	4.66	69.51		
2480.0	1000	H	1.16	37	79.09	48.64	10.44	28.38	4.71	73.98	Not Applicable	
2480.0	1000	V	1.00	295	75.82	48.64	10.44	28.38	4.71	70.71		
2491.6	1000	H	1.16	37	40.36	48.65	10.44	28.40	4.72	35.27	54.00	18.73
2502.4	1000	V	1.00	295	40.29	48.65	10.44	28.43	4.73	35.24	54.00	18.76

Margin (dB) = Limit – Actual
[Actual = Reading – Amp Gain + Attenuator + AF + CL]
1. H = Horizontal, V = Vertical Polarization
2. ATT = Attenuation (10dB pad and/or Insertion Loss of HPF), AF/CL = Antenna Factor and Cable Loss
   NOTE: "---" means the emission level was too low to be measured or in the noise floor.

Figure 3. Plot of the Band Edge (Conducted)

Lowest Channel (2402 MHz)



Highest Channel (2480 MHz)

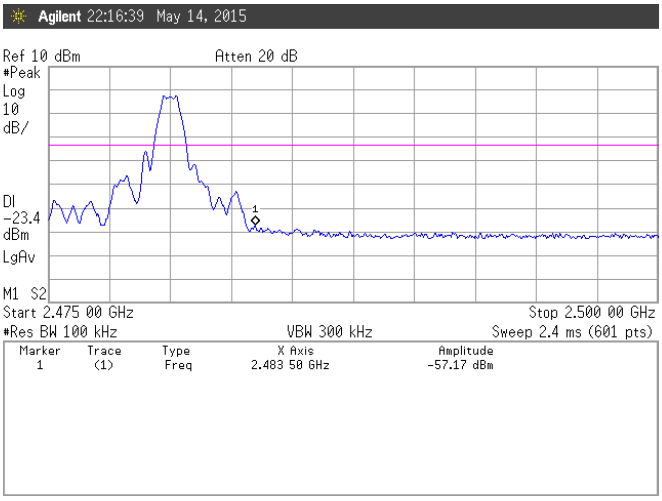
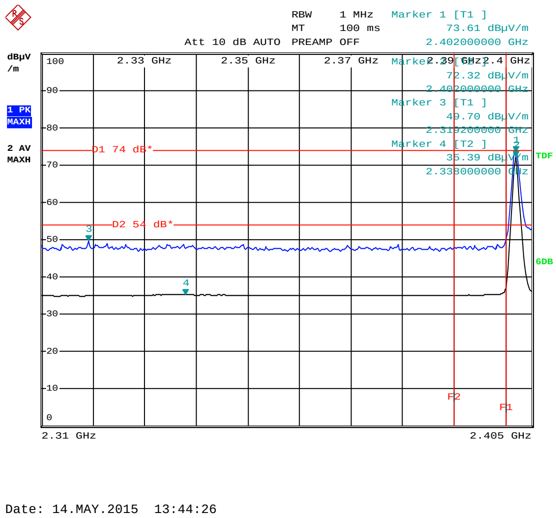
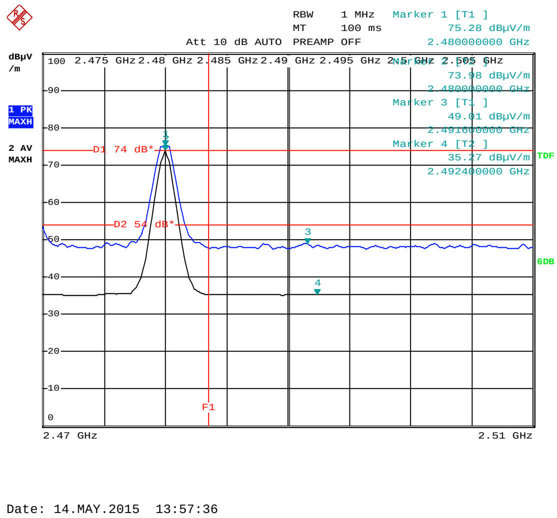


Figure 4. Plot of the Band Edge (Radiated)

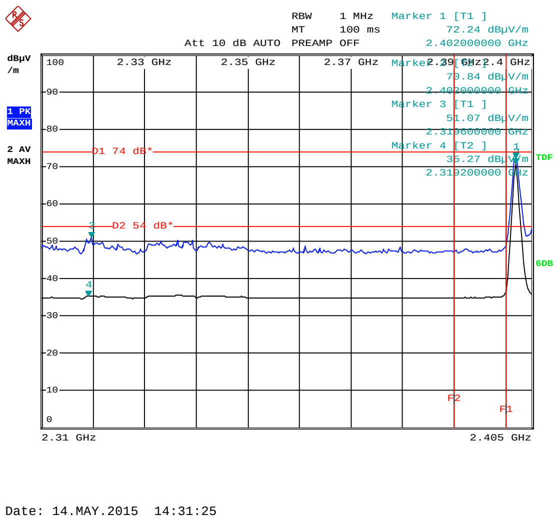
Lowest Channel (2402 MHz)
Horizontal



Highest Channel (2480 MHz)
Horizontal



Lowest Channel (2402 MHz)
Vertical



Highest Channel (2480 MHz)
Vertical

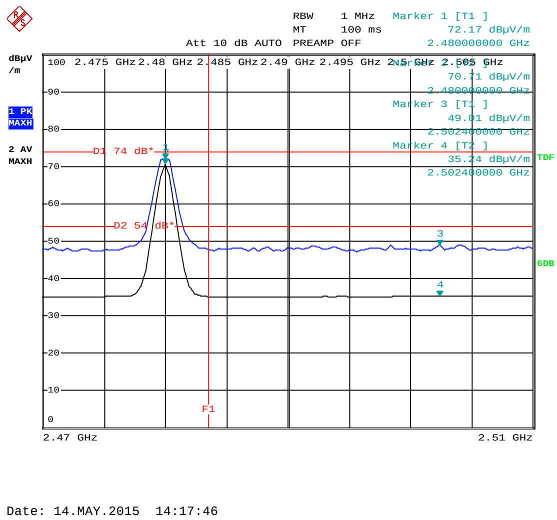
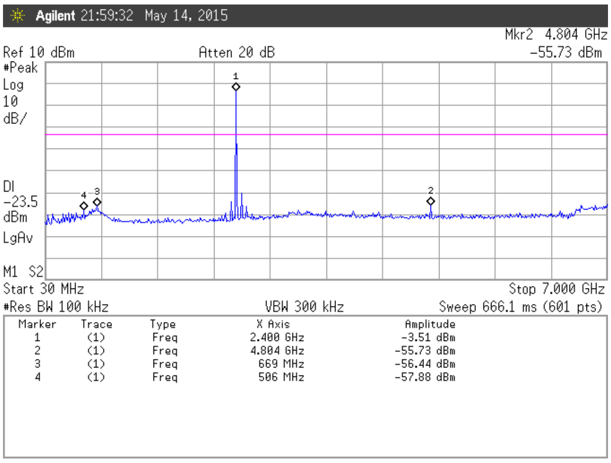
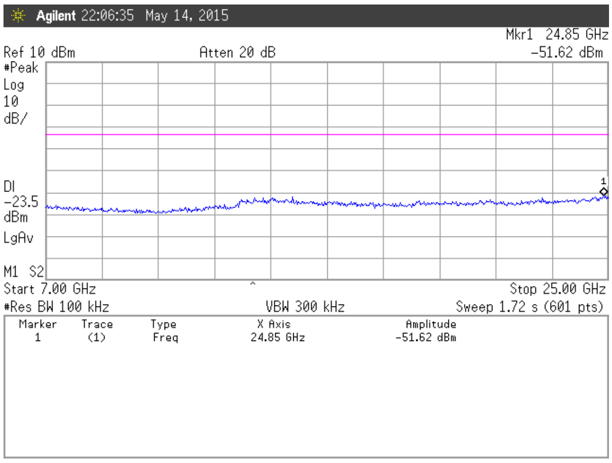


Figure 5. Spurious RF conducted emissions

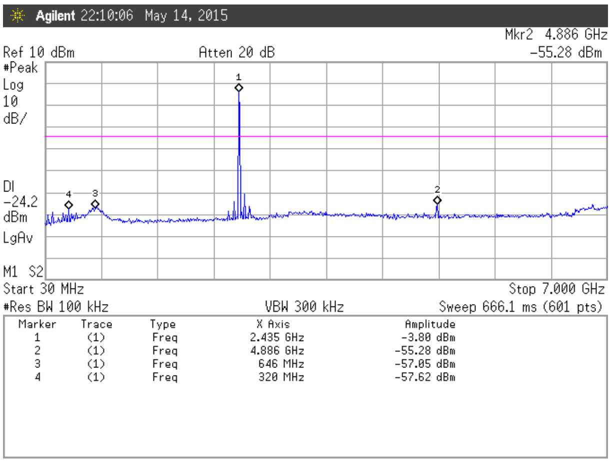
Lowest Channel (2402 MHz): 30 MHz ~ 7 GHz



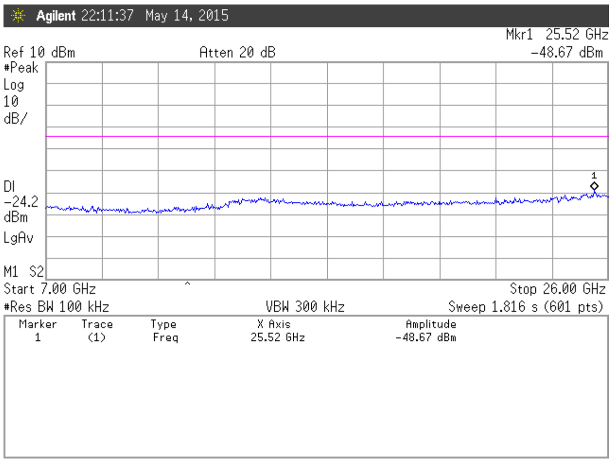
Lowest Channel (2402 MHz): 7 GHz ~ 25 GHz



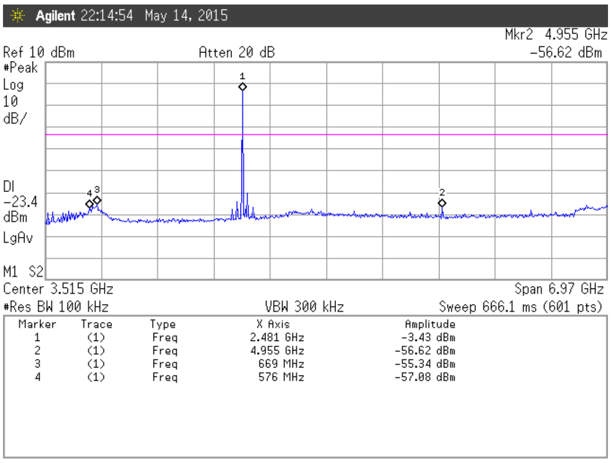
Middle Channel (2440 MHz): 30 MHz ~ 7 GHz



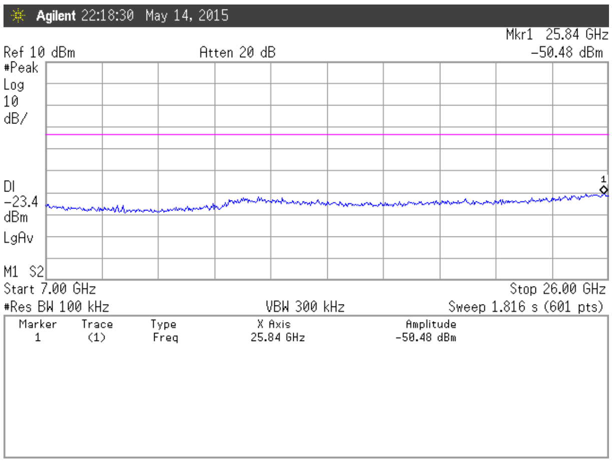
Middle Channel (2440 MHz): 7 GHz ~ 25 GHz



Highest Channel (2480 MHz): 30 MHz ~ 7 GHz



Highest Channel (2480 MHz): 7 GHz ~ 25 GHz



5.5. Peak power spectral density

5.5.1 Regulation

According to §15.247(e), 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. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

5.5.2 Test Procedure(peak PSD)

Set the spectrum analyzer as follows:

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 x 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.

5.5.3 Test Results: PASS

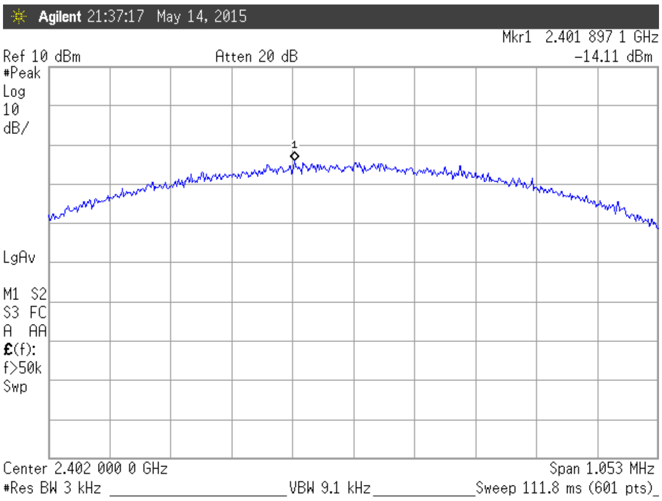
Table 4: Measured values of the Peak Power Spectral Density

Modulation	Operating frequency	PSD/3 kHz (dBm)	Limit (dBm)
GFSK	2402 MHz	-14.11	8
	2440 MHz	-13.80	8
	2480 MHz	-13.54	8

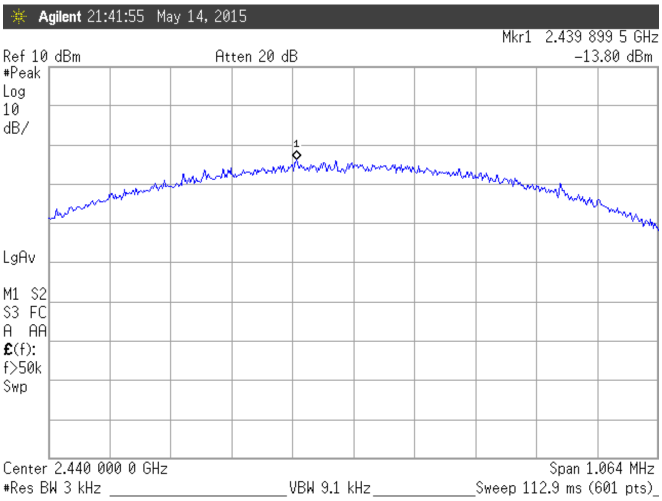
NOTE: We took the insertion loss of the cable loss into consideration within the measuring instrument.

Figure 6. Plot of the Peak Power Spectral Density

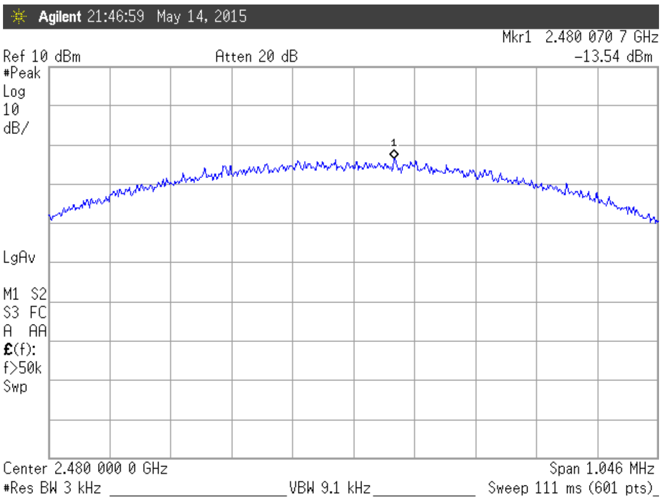
Lowest Channel (2402 MHz)



Middle Channel (2440 MHz)



Highest Channel (2480 MHz)



5.6. AC power line conducted emissions

5.6.1 Regulation

According to §15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Qausi-peak	Average
0.15 – 0.5	66 to 56 *	56 to 46 *
0.5 – 5	56	46
5 – 30	60	50

* Decreases with the logarithm of the frequency.

According to §15.107(a), for unintentional device, except for Class A digital devices, line conducted emission limits are the same as the above table.

5.6.2 Test Procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5m away from the side wall of the shielded room.
2. Each current-carrying conductor of the EUT power cord was individually connected through a 50Ω/50μH LISN, which is an input transducer to a Spectrum Analyzer or an EMI/Field Intensity Meter, to the input power source.
3. Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
5. The measurements were made with the detector set to PEAK amplitude within a bandwidth of 10 kHz or to QUASI-PEAK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

5.6.3 Test Results: PASS

Table 5: Measured values of the AC Power Line Conducted Emissions

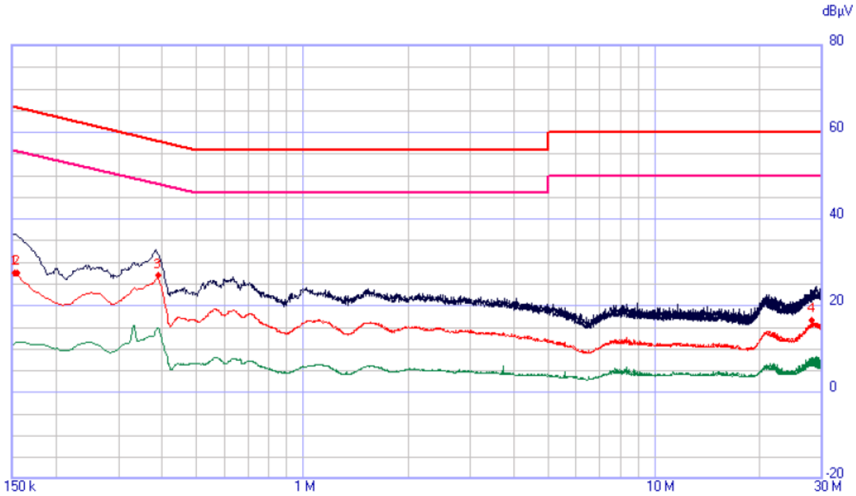
Frequency [MHz]	L / N	CF [dB]	CL [dB]	Actual [dBμV]	Limit [dBμV]	Margin [dB]
QUASI-PEAK DATA						
0.1520	N	0.26	0.04	27.84	65.89	38.05
0.1541	N	0.26	0.04	27.76	65.78	38.02
0.3872	L	0.13	0.06	26.35	58.12	31.77
0.6306	N	0.28	0.08	15.54	56.00	40.46
28.0622	L	0.50	0.37	16.12	60.00	43.88
AVERAGE DATA						
0.1520	N	0.26	0.04	9.51	55.89	46.38
0.1541	N	0.26	0.04	9.48	55.78	46.30
0.3872	L	0.13	0.06	14.89	48.12	33.23
0.6306	N	0.28	0.08	5.09	46.00	40.91
28.0622	L	0.50	0.37	8.06	50.00	41.94

Margin (dB) = Limit – Actual
[Actual = Reading + CF + CL]
L/N = LINE / NEUTRAL
CF/CL = Correction Factor and Cable Loss

NOTE: The frequency range was scanned from 150 kHz to 30 MHz. All emissions not reported were more than 20 dB below the specified limit.

Figure 7. Plot of the AC Power Line Conducted Emissions

Line – PE



SKTEU15-0300_L

	Start [MHz]	Stop [MHz]	Step	Detector	Hold Time	RBW	Min Att	Pre Amp	Pre Sel	Prompt start	Ancillary
1	0.15	30	AUTO (2.045 kHz)	P Q C 22_QP_B 22_CAV_B	1500 ms	9 kHz	10	ON	ON	...	...

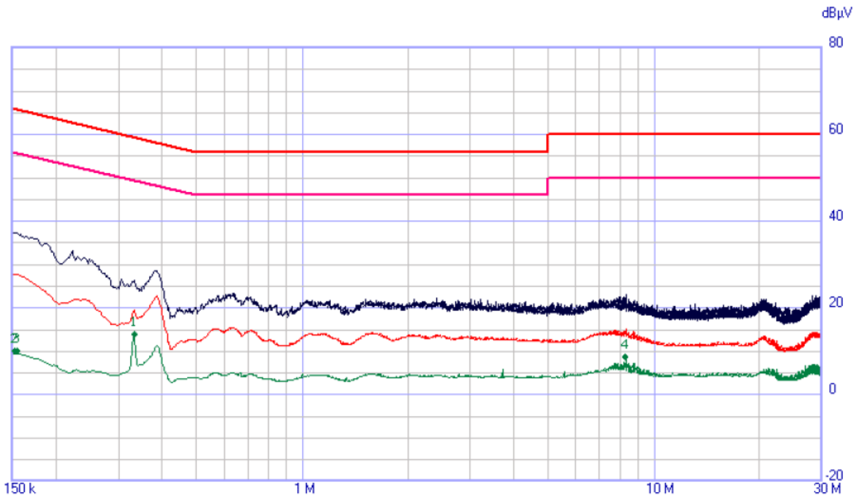
Pulse Limiter ON
Ancillary = General
Worst = 3

Limits:
22_QP_B
22_CAV_B

Factors:
ESH2-Z5_L__2014.07.09
OLD_CL__2014.12.26

Peak
QPeak
C-Avg

Neutral – PE



SKTEU15-0300_N

	Start [MHz]	Stop [MHz]	Step	Detector	Hold Time	RBW	Min Att	Pre Amp	Pre Sel	Prompt start	Ancillary
1	0.15	30	AUTO (2.045 kHz)	P Q C 22_QP_B 22_CAV_B	1500 ms	9 kHz	10	ON	ON	...	...

Pulse Limiter ON
Ancillary = General
Worst = 3

Limits:
22_QP_B
22_CAV_B

Factors:
ESH2-Z5_N__2014.07.09
OLD_CL__2014.12.26

Peak
QPeak
C-Avg